

HYDROLOGIC & HYDRAULIC REPORT
“The Village At Institute Road”
In
Grafton Main, Massachusetts

EXHIBIT

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**PLANNING BOARD
GRAFTON, MA**

FILE



September 13, 2016
Rev. 5/21/17

Prepared for:

D&F Afonso Builders, Inc.
189 Main Street
Milford MA 01757

Prepared by:

Guerriere & Halnon Inc
333 West Street
Milford, MA 01757

HYDROLOGIC & HYDRAULIC REPORT
"The Village At Institute Road", Grafton Ma
Rev. 5/21/17

SITE LOCATION & DESCRIPTION

The site is located off of Institute Road in Grafton Massachusetts. Figure 1 shows the site locus.

The project locus contains approximately 62.9 acres of land. The existing property is presently undeveloped and consists of one lot. The site consists of mainly wooded area. The parcel has many cart paths that run throughout it as shown on Pre-Development Drainage Map. The existing topography slopes from southeast to northwest toward the wetland located in the northwest corner of the lot. The parcel also has a vernal pool located in the center of the project adjacent to Institute Road.

PROJECT DESCRIPTION

The project proponent proposes to construct a 46 lot residential development. This development is known as "The Village At Institute Road" and consists of 46 single family homes serviced by public water and sewer and driveway as shown conceptual on the Definitive Plans. The development also includes construction of three 26' wide paved roadways as shown on the plans. The proposed drainage system will consist of catch basins and drain manholes along the proposed roadways and directed to a forebay and infiltration basin.

DESCRIPTION OF EXISTING DRAINAGE FACILITIES

In present condition the project was divided into 4 drainage areas with four interest points as shown on the drainage map. The first interest point is an isolated wetland located at the center of the site adjacent to Institute Road. The second interest point is the property line to the west of the project. The third interest point is the wetland located in the northwest corner and the fourth interest point is the property line to the north. The drainage areas are as follows:

1. Drainage Area E1 consists of woodland and a portion of Institute Road. This Drainage Area flows from the site toward the wetland located adjacent to the Institute Road. This is a vernal pool and isolated wetland(IP#1).
 2. Drainage Area E2 consists of woodland area with gravel cart paths that run through the drainage area. This runoff flows toward the west property line.(IP#2)
 3. Drainage Area E3 consists of woodland area, existing site adjacent to the project. This drainage area flows overland toward large wetland located in the northwest corner of the lot. (#IP3)
 4. Drainage Area E4 consists of woodland area that flows overland offsite toward the north. (IP#4)
 5. Drainage Area E5 consists of woodland area that flows overland offsite toward property line. (IP#5)
6. All Drainage Areas will have roof area directed into recharge areas.

Please refer to the Pre-Development Plan.

DESCRIPTION OF PROPOSED DRAINAGE FACILITIES

In the proposed state there will be four (4) general runoff areas. They are as follows:

1. Drainage Area 1P will be collected and directed runoff into a water quality grass swale toward the existing wetland located adjacent to Institute Road, which is also a vernal pool. This area consists of a grass area along the back of the proposed house, portion of driveways and roofs from the proposed houses and woodland areas that will remain undisturbed and portion of Institution Road. (#IP1P)
2. Drainage area 2P will be direct runoff toward the west property line. This area consists of a grass area in back yards along the new street and portion of driveways and roofs from the proposed houses and portion of proposed street. (#IP2P)
3. Drainage area 3P will be collected by catch basins in proposed roadways and directed into proposed stormceptor then forebay and then into proposed infiltration basin. The area will discharge into wetlands located in the northwest corner of project. This area consists of a grass area, wooded area, driveway and portion of the new street as well as portion of existing street. (#IP3P)
4. Drainage area 4P will be direct runoff toward Westboro Road and the area consists of lawn area, wooded area, driveways and roof area.
5. Drainage area 5P will be runoff generated from wooded and grass area that flows directly into the wetlands.
6. Drainage area 6P will be runoff collected by drainage channel along portion of new street and directed into basin#2. This area consists of a grass area in the front yards along the new street and portion of driveways and roofs from the proposed houses and portion of proposed street. (#IP3P).
7. Drainage area 7P will be runoff generated from wooded and grass area that flows directly into the wetlands.
- 8.

CALCULATION PROCEDURE

Procedures developed by the U. S. Department of Agriculture Soil Conservation Service (SCS) as found in Technical Release 20 (TR20) were used to determine the rates and volumes of runoff generated by the study area. Calculations were performed using the computer program "HydroCAD" by Applied Microcomputer Systems, which has incorporated these SCS procedures. Pipe capacities were determined using Manning's Equations.

Runoff Areas are shown on the attached Drainage Area Plans. Calculation was done for the Two (2), Ten (10), Twenty Five (25), Fifty (50) and One Hundred-(100) Year storms. Rainfall depths used for these storms were 3.28, 4.89, 6.22, 7.42 and 8.84 inches respectively. Calculation summaries are attached to this report.

SOIL MAPS

The SCS has also performed soil mapping of the South Worcester County. The soils mapping indicate that the site is located within Hydrologic Soil Group B, See the Pre & Post Development Plans. Deep hole tests and perc tests were done throughout the Site refer, to the Grading Plan for locations. Deep test hole results indicate that the proposed underground basins are located in loamy sand & gravelly material and have a perc rate of less than 10 minutes per inch.

POLLUTANT REMOVAL

This project will incorporate facilities that will collect stormwater pollutants. Collection of pollutants will be accomplished by:

- a. Deep sump catch basins 25%

- b. Stormceptor 80%
 - c. Infiltration Basins 80%
 - e. Grass Swale 50%
- (Refer to attached worksheets)

SUMMARY REACH IP#1
 (Wetlands – Vernal Pool)

Storm Event	Pre-Development		Post-Development	
2 yr.	1.26	cfs	0.181	af
10 yr.	4.86	cfs	0.544	af
25 yr.	8.88	cfs	0.933	af
50 yr.	12.96	cfs	1.330	af
100 yr.	18.16	cfs	1.841	af

SUMMARY REACH IP#2
 (West Property Line)

Storm Event	Pre-Development		Post-Development	
2 yr.	2.67	cfs	0.379	af
10 yr.	11.34	cfs	1.142	af
25 yr.	20.75	cfs	1.956	af
50 yr.	30.28	cfs	2.788	af
100 yr.	42.43	cfs	3.860	af

SUMMARY REACH IP#3
 (Wetlands Northwest Corner PArcel)

Storm Event	Pre-Development		Post-Development	
2 yr.	4.33	cfs	0.730	af
10 yr.	16.16	cfs	2.133	af
25 yr.	28.80	cfs	3.613	af
50 yr.	41.53	cfs	5.118	af
100 yr.	57.70	cfs	7.051	af

SUMMARY REACH IP#4
 (North Property Line)

Storm Event	Pre-Development		Post-Development	
2 yr.	1.92	cfs	0.292	af
10 yr.	7.88	cfs	1.117	af
25 yr.	14.32	cfs	1.915	af
50 yr.	20.86	cfs	2.732	af
100 yr.	29.19	cfs	3.785	af

Basin Summary Table

BASINS PROPOSED CONDITIONS

BASIN	UNITS	100 YR.	50 YR.	25 YR.	10 YR.	2 YR
1	Qin = CFS	35.54	27.54	20.93	13.90	6.22
	Qout = CFS	11.05	8.45	4.98	3.60	1.32
	ELEV. = FT	380.39	379.35	378.43	377.08	375.66
	VOL. ST. = cf	72,625	56,915	44,354	28,066	13,641
2	Qin = CFS	22.11	16.34	11.71	7.02	2.33
	Qout = CFS	12.98	9.89	6.35	4.19	0.99
	ELEV. = FT	374.66	373.74	372.90	371.77	370.61
	VOL. ST. = cf	34,912	26,136	19,187	11,359	5,202

Soil Information

Stormwater Report
“The Village At Institute Road”
Grafton, MA

Date: September 13, 2016
Revised February 2, 2017
April 13, 2017



Prepared For:
D&F Afonso Builder Corp.
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G&H Project G-9411

Narrative:

The project proponent proposes to construct a 46 lot residential development. This development is known as "The Village At Institute Road" and consists of 46 single family homes serviced by public water and sewer and driveway as shown conceptual on the Definitive Plans. The development also includes construction of three 26' wide paved roadways as shown on the plans. The proposed drainage system will consist of catch basins and drain manholes along the proposed roadways and directed to a forebay and infiltration basin.

The itemized report that follows will document design compliance with the Massachusetts Stormwater Management Standards 1-10.

Date



Peter M. Lavoie

Standard 1: No new stormwater conveyances (e.g. outfalls) may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Proposed – All road drainage is being collected and treated at the proposed basin. The new outfall discharges, treated stormwater in compliance with Standards 4 through 6.

Evaluated at a 100-year 24-hour storm event, the peak velocity of any the new outfall is non-erosive to proposed receiving surface.

Standard 2: Stormwater management systems shall be designed so that the post-development peak discharge rates do not exceed pre-development peak discharge rates. This Standard may be waived for discharges to land subject to coastal storm flowage as defined in 310 CMR 10.04.

To meet Standard 2, the post-development peak discharge rate must be equal to or less than pre-development rates to prevent storm damage and downstream flooding from the 2-year and the 10-year 24-hour storm events.

Peak discharge rates were calculated and evaluated at four locations for this project. The point of evaluation is shown on the accompanying drainage plans designated as “IP#1(vernal pool), IP#2(Property Line – West), IP#3 Wetlands Northwest corner) and IP#4(Westboro Road – North) “respectively for the pre-development conditions and post-development conditions.

In summary of the detailed calculations attached, the peak discharge rates in cubic feet per second (cfs) Please refer to the Existing & Proposed Conditions Table.

Standard 3: Loss of annual recharge to ground water shall be eliminated or minimized through the use of environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post- development site shall approximate the annual recharge from pre-development conditions based on soil type. This standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Hydrologic Group	Volume to Recharge x Total Impervious Area
A	0.60 inches of runoff
C	0.25 inches of runoff
B	0.35 inches of runoff
D	0.10 inches of runoff

Soils underlying the site are defined as hydrologic group “A” * (*USDA/NRCS Soil Survey of Middlesex County). From soil testing and soil texture performed in field the soil classification is B.

The required volume of recharge for post-development conditions is calculated as follows;

Total impervious area = 1,811,296 s.f.(0.35 inches/12 inches) = 52,829 c.f.

The volume of recharge provided for post-development conditions is as follows;

BMP utilized – Infiltration Basins

Recharge Basin 1	
Bottom of basin elevation	474.00
Overflow elevation	481.00
Total storage/recharge height	7.0
Total storage/recharge volume	64,442 cf
(see recharge storage table)	

Total Recharge Volume Provided 64,442 cf

BMP utilized – Infiltration Basins

Recharge Basin 2	
Bottom of basin elevation	470.00
Overflow elevation	475.00
Total storage/recharge height	5.0
Total storage/recharge volume	38,325 cf
(see recharge storage table)	

Total Recharge Volume Provided 38,325 cf

Soils

Field investigations of the soils reveal the following soil profiled for the basins:

See Soil logs.

Standard 4: Stormwater management systems shall be designed to remove 80% of the average annual post-construction load of Total Suspended Solids (TSS). This standard is met when:

- a) *Suitable practices for source control and pollution prevention are identified in a long-term pollution prevention plan, and thereafter are implemented and maintained;*
- b) *Structural stormwater best management practices are sized to capture the required water quality volume as determined in accordance with the Massachusetts Stormwater Handbook; and*
- c) *Pretreatment is provided in accordance with the Massachusetts Stormwater Handbook.*

The required Water Quality Volume, the runoff volume requiring 80% TSS removal, is calculated as follows:

Refer to the TSS worksheets.

Standard 4 requires the development and implementation of suitable practices for source control and pollution prevention. These measures must be identified in a long-term pollution prevention plan.

The long-term pollution prevention plan is incorporated into the Operation and Maintenance Plan required by Standard 9.

Standard 5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable.

The proposed project is not a use with higher potential pollutant loads.

Standard 6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply and stormwater discharges near or to any other critical area require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook.

The subject property does discharge storm water within the Zone II or Interim Wellhead Protection Area of a public water supply or to any other critical area. Pretreatment has been added to treat runoff prior to discharge into the proposed infiltration basins

Standard 7: A redevelopment project is required to meet the following Stormwater Management Standards only to the maximum extent practicable:

It is not a redevelopment project.

Standard 8: A plan to control construction-related impacts, including erosion, sedimentation, and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented.

During land disturbance and construction activities, project proponents must implement controls that prevent erosion, control sediment movement, and stabilize exposed soils to prevent pollutants from moving offsite or entering wetlands or waters. Land disturbance activities include demolition, construction, clearing, excavation, grading, filling, and reconstruction.

Standard 8, cont'd.

Construction Period Pollution Prevention Plan and Erosion and Sedimentation Control.
EPA NPDES – Storm Water Pollution Prevention Plan (SWPPP)

A. Names of Persons or Entity Responsible for Plan Compliance

Owner/Applicant: D&F Afonso Builders Corp.
189 Main Street
Milford MA 01757

B. Construction Period Pollution Prevention Measures

1. Inventory materials to be present on site during construction.
2. Train employees and subcontractors in prevention and clean up procedures.
3. All materials stored on site will be stored in their appropriate containers and if possible under a roof or covered.
4. Follow manufacturer's recommendation for disposal of used containers.
5. Store only enough product on site to do the job.
6. On site equipment, fueling and maintenance measures:
 - a. Inspect on-site vehicles and equipment daily for leaks.
 - b. Conduct all vehicle and equipment maintenance and refueling in front of building, away from storm drains.
 - c. Perform major repairs and maintenance off site.
 - d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
 - e. Collect spent fuels and remove from site, per Local and State regulations.
 - f. Maintain a clean construction entrance where truck traffic is frequent to reduce soil compaction constant sweeping is required and limit tracking of sediment into streets, sweeping street when silt is observed on street.
7. Stock pile materials, and maintain Erosion Control around the materials where it can easily be accessed. Maintain easy access to clean up materials to include brooms, mops, rags gloves, goggles, sand, sawdust, plastic and metal trash containers.
8. Clean up spills.
 - a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
 - b. Sweep up dry materials immediately. Never wash them away or bury them.
 - c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil in a certified container and notify a certified hauler for removal.
 - d. Report significant spills to the Fire Department.
9. It is the responsibility of the site superintendent or employees designated by the Applicant to inspect erosion control and repair as needed, also to inspect all on site vehicles for leaks and check all containers on site that may contain hazardous materials daily.

C. Erosion and Sedimentation Control Plan;

1. See Erosion Control Plans.

D. Site Development Plans;

1. See Grading Plans.

E. Construction Plans

1. Construction Sequencing Plan
 - a. Record Order of Conditions – The site superintendent shall be aware of all the Conditions contained within the Order including inspection schedules.
 - b. Install DEP File # Sign.
 - c. Prior to any work on the site including tree/brush clearing, the approved limit of clearing as well as the location of the proposed erosion control devices (such as silt

- fence/straw bales, etc.) must be staked on the ground under the direction of a Massachusetts registered Professional Land Surveyor.
- d. Install silt fence/mulch sock at locations
 - e. Strip off top and subsoil. Stockpile material to be reused away from the wetland, remove excess material from the site. Install and maintain erosion control barrier around stockpile.
 - f. Rough grade site, maintaining a temporary low area/sediment trap away from the wetland.
 - g. Construct drainage outfalls and stilling basin. Stabilize side slopes with loam, seed and mulch.
 - h. Install underground utilities; protect all open drainage structures with erosion/siltation control devices.
 - i. Install binder course of bituminous asphalt.
 - j. Install wearing course of asphalt, and striping (where required).
 - k. Maintain all erosion control devices until site is stabilized and a Certificate of Compliance is issued by the Conservation Commission.
 - l. The Contractor shall be responsible to schedule any required inspections of his/her work.
2. Construction Waste Management Plan
 - a. Dumpster for trash and bulk waste collection shall be provided separately for construction.
 - b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material are recommended.
 - c. Segregate and provide containers for disposal options for waste.
 - d. Do not bury waste and debris on site.
 - e. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.
 - f. The sewer system is only for disposal of human waste, and substances permitted for disposal in the site sewer permit with the Town DPW.

F. Operation and Maintenance of Erosion and Sedimentation Controls

The operation and maintenance of sedimentation control shall be the responsibility of the contractor. The inspection and maintenance of the stormwater component shall be performed as noted below. The contractor shall have erosion control in place at all times. The contractor, based on future weather reports, shall prepare and inspect all erosion control devices; cleaning, repairing and upgrading is a priority so that the devices perform as per design. Inspect the site during rain events. Don't stay away from the site. At a minimum there should be inspection to assure the devices are not clogged or plugged, or that devices have not been destroyed or damaged during the rain event. After a storm event inspection is required to clean and repair any damage components. Immediate repair is required.

G. Inspection and Maintenance Schedules

1. Inspection must be conducted at least once every 7 days and within 24 hours of the end of a storm event 0.5 inches or greater.
2. Inspection frequency can be reduced to once a month if:
 - a. The site is temporarily stabilized.
 - b. Runoff is unlikely due to winter conditions, when site is covered with snow or ice.
3. Inspections must be conducted by qualified personnel, "qualified personnel" means a person knowledgeable in the principles and practice of erosion and sediment controls and who possess the skills to assess the conditions and take measures to maintain and ensure proper operation, also to conclude if the erosion control methods selected are effective.

4. For each inspection, the inspection report must include: (See attached inspection and maintenance log)
 - a. The inspection date.
 - b. Names, titles of personnel making the inspection.
 - c. Weather information for the period since the last inspection.
 - d. Weather information at the time of the inspection.
 - e. Locations of discharges of sediment from the site, if any.
 - f. Locations of BMP's that need to be maintained.
 - g. Locations where additional BMP's may be required.
 - h. Corrective action required or any changes to the SWPPP that may be necessary.

5. The owner, or their representative, such as the contractor, shall inspect the following in-place work;

Inspection Schedule:

Erosion Control	Weekly
Catch Basins & Drop Inlets	Weekly
Temporary Sedimentation Traps/Basins	Weekly
Street & Parking Area Sweeping	Daily

Please Note: Special inspections shall also be made after a significant rainfall event.

Maintenance Schedule

Erosion Control Devices Failure	Immediately
Catch Basins	Sump 1/4 full of sediment
Temporary Sedimentation Traps/Basins	As needed
Street Sweeping	14 days minimum and prior to any significant rain event.

Please Note: Special maintenance shall also be made after a significant rainfall event.

H. Inspection and Maintenance Log Form. (Log Form Follows)

Standard 9: A Long –Term Operation and Maintenance (O&M) Plan shall be developed and implemented to ensure that stormwater management systems function as designed.

The following shall serve as the (O&M) Plan required by Standard 9, as well as the Long Term Pollution Prevention Plan required by Standard 4.

A. Names of Persons or Entity Responsible for Plan Compliance:

Owner/Applicant: Town of Grafton

B. Good housekeeping practices

1. Maintain site, landscaping and vegetation.
2. Sweep and pick up litter on pavements and grounds.
3. Deliveries shall be monitored by owners or representative to ensure that if any spillage occurs, it shall be contained and cleaned up immediately.
4. Maintain pavement and curbing in good repair.

C. Requirements for routine inspections and maintenance of stormwater BMPs

1. Plans: The stormwater Operation and Maintenance Plan shall consist of all Plans, documents and all local state and federal approvals as required for the subject property.
2. Record Keeping:
 - a. Maintain a log of all operation and maintenance activities for at least three years following construction, including inspections, repairs, replacement and disposal (for disposal, the log shall indicate the type of material and the disposal location);
 - b. Make this log available to MassDEP and the Conservation Commission upon request; and
 - c. Allow MassDEP and the Conservation Commission to inspect each BMP to determine whether the responsible party is implementing the Operation and Maintenance Plan.
3. Descriptions and Designs: The Best Management Practices (BMP) incorporated into the design include the following:
 - a. Street Sweeping – Stipulated within the Construction Period Pollution Prevention Plan, the Long Term Pollution Prevention Plan, and the Operation and Maintenance Plan. As the amount of TSS removal is discretionary, no credit was taken within the calculations for this BMP.
 - b. Deep sump catch basins with hoods installed to promote TSS Removal of solids and control floatable pollutants. This BMP has a design rate of 25% TSS Removal.
 - c. Forebay TSS Removal of solids and control floatable pollutants This BMP has a design rate of 25% TSS Removal.
 - d. Infiltration basin to provide the required recharge as well as provide an additional 80% TSS Removal. Refer to TSS Removal Worksheet in Standard 4 for treatment train.
4. BMP Maintenance: After construction it is the responsibility of the owner to perform maintenance. The cleaning of the components of the stormwater management system shall generally be as follows:
 - a. Roadway & Parking Areas: The owner shall keep the roadway swept with a mechanical sweeper semi-annually at a minimum.
 - b. Catch Basins: Shall be cleaned by excavating, pumping or vacuuming. The sediment shall be disposed of off-site by the Owner. Inspect quarterly, remove silt when ¼ full.
 - c. Infiltration Basins: Inspect twice per year and after every major event for the first few months. Clean sediment out of isolator row in basins 2 times per year.

- d. Settling Basins & Forebay: Mow basins at least twice per year. Clean sediment out of basins 2 times per year.
- 5. Access Provisions: All of the components of the storm water system will be accessible by the Owner

D. Spill prevention and response plans

- 1. Inventory materials to be present on site during construction.
- 2. Train employees and subcontractors in prevention and clean up procedures.
- 3. All materials stored on site will be stored in their appropriate containers under a roof.
- 4. Follow manufacturers recommendation for disposal of used containers.
- 5. Store only enough product on site to do the job.
- 6. On site equipment, fueling and maintenance measures:
 - a. Inspect on-site vehicles and equipment daily for leaks.
 - b. Conduct all vehicle and equipment maintenance and refueling in one location, away from storm drains.
 - c. Perform major repairs and maintenance off site.
 - d. Use drip pans, drip cloths or absorbent pads when replacing spent fuels.
 - e. Collect spent fuels and remove from site.
- 7. Clean up spills.
 - a. Never hose down "dirty" pavement or impermeable surfaces where fluids have spilled. Use dry clean up methods (sawdust, cat litter and/or rags and absorbent pads).
 - b. Sweep up dry materials immediately. Never wash them away or bury them.
 - c. Clean up spills on dirt areas by digging up and properly disposing of contaminated soil.
 - d. Report significant spills to the Fire Department, Conservation Commission and Board of Health.

E. Provisions for maintenance of lawns, gardens, and other landscaped areas

Use only organic fertilizer. Dispose of clippings outside of the 100 foot buffer zone to the adjacent wetland.

F. Requirements for storage and use of herbicides, and pesticides

The application of herbicides or pesticides will be done by professional certified contractor.

G. Provisions for operation and management of septic system

The system shall be inspected and maintained according to the schedule noted on the approved Board of Health plan.

H. Provisions for solid waste management

- 1. Waste Management Plan
 - a. Dumpster for trash and bulk waste collection shall be stored inside or under a roof.
 - b. Recycle materials whenever possible (paper, plaster cardboard, metal cans). Separate containers for material is recommended.
 - c. Do not bury waste and debris on site.
 - d. Certified haulers will be hired to remove the dumpster container waste as needed. Recycling products will also be removed off site weekly.

I. Snow disposal and plowing plans relative to Wetland Resource Areas

Snow storage is adequate around the site for small storm events. The owner will have to coordinate snow removal to off site location due to the developments size and location of wetlands.

- J. Winter Road Salt and/or Sand Use and Storage restrictions
No sand, salt, or chemicals for de-icing will be stored outside.
- K. Street and parking lot sweeping schedules
Sweeping, the act of cleaning pavement can be done by mechanical sweepers, vacuum sweeper or hand sweeper. The quantity of sand is a direct correlation with the treatment of ice and snow and the types of chemicals and spreaders that are being used on site to manage snow. If a liquid de-icer such as calcium chloride is used as a pretreatment to new events the amount of sand is minimized. Sweeping for this site should be done semi-annually at a minimum. Collecting the particulate before it enters the catch basins is cheaper and more environmentally friendly than in a catch basin mixing with oils and greases in the surface water runoff in catch basins.
- L. Provisions for prevention of illicit discharges to the stormwater management system
The discharge into the stormwater system is not being violated, see attachment for illicit discharges compliance.
- M. Training the staff or personnel involved with implementing Long-Term Pollution Prevention Plan
The owner shall develop policies and procedures for containing the illicit spilling of oils, soda, beer, paper and litter. These wastes provide a degrading of the water quality. The placement of signs and trash barrels with lids around the site would contribute to a clean water quality site conditions.
- N. List of Emergency contacts for implementing Long-Term Pollution Prevention Plan:
Town of Grafton

Standard 10: All illicit discharges to the stormwater management system are prohibited.

Standard 10 prohibits illicit discharges to stormwater management systems. The stormwater management system is the system for conveying, treating, and infiltrating stormwater on site, including stormwater best management practices and any pipes intended to transport stormwater to the ground water, a surface water, or municipal separate storm sewer system. Illicit discharges to the stormwater management system are discharges that are not entirely comprised of stormwater. Notwithstanding the foregoing, an illicit discharge does not include discharges from the following activities or facilities: firefighting, water line flushing, landscape irrigation, uncontaminated ground water, potable water sources, foundation drains, air conditioning condensation, footing drains, individual resident car washing, flows from riparian habitats and wetlands, dechlorinated water from swimming pools, water used for street washing and water used to clean residential buildings without detergents.

Proponents of projects within Wetlands jurisdiction must demonstrate compliance with this requirement by submitting to the issuing authority an Illicit Discharge Compliance Statement verifying that no illicit discharges exist on the site and by including in the pollution prevention plan measures to prevent illicit discharges to the stormwater management system, including wastewater discharges and discharges of stormwater contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, oil, or grease. The Illicit Discharge Compliance Statement may be filed with the Notice of Intent. If the Illicit Discharge Compliance Statement has not been filed, the Final Order of Conditions shall require the submission of an Illicit Discharge Compliance Statement prior to the start of construction. The issuing authority should not issue a Certificate of Compliance until it has determined that the Illicit Discharge Compliance Statement has been submitted, has reviewed the Illicit Discharge Compliance Statement, and has verified that there are no illicit discharges at the site.

(Illicit Discharge Compliance Statement Follows)

Attachment
Illicit Discharge Compliance Statement

It is the intent of the Applicant D&F Afonso Builders Corp. to control illicit disposal into the storm drainage system. There will be no connection to the storm water system to inadvertently direct other types of liquids, chemicals or solids into the storm drainage system. The Applicant will also promote a clean Green Environment by mitigating spills onto pavements; oils, soda, chemicals, pet waste, debris and litter.

Respectfully Acknowledged,



D&F Afonso Builders Corp

Massachusetts Stormwater Report Checklist

not been submitted, the applicant must provide an explanation. The completed Stormwater Report Checklist and Certification must be submitted with the Stormwater Report.

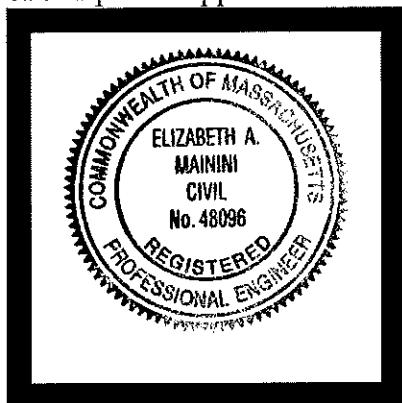
Stormwater Checklist and Certification

The following checklist is intended to serve as a guide for applicants as to the elements that ordinarily need to be addressed in a complete Stormwater Report. The checklist is also intended to provide conservation commissions and other reviewing authorities with a summary of the components necessary to comprise a comprehensive Stormwater Report that addresses the ten Stormwater Standards. *Note:* Because stormwater requirements vary from project to project, it is possible that a complete Stormwater Report may not include information on some of the subjects specified in the Checklist. If it is determined that a specific item does not apply to the project under review, please note that the item is not applicable (N.A.) and provide the reasons for that determination.

A complete checklist must include the Certification set forth below signed by the Registered Professional Engineer who prepared the Stormwater Report.

Registered Professional Engineer's Certification

I have reviewed the Stormwater Report, including the soil evaluation, computations, Long-term Pollution Prevention Plan, the Construction Period Erosion and Sedimentation Control Plan (if included), the Long-term Post-Construction Operation and Maintenance Plan, the Illicit Discharge Compliance Statement (if included) and the plans showing the stormwater management system, and have determined that they have been prepared in accordance with the requirements of the Stormwater Management Standards as further elaborated by the Massachusetts Stormwater Handbook. I have also determined that the information presented in the Stormwater Checklist is accurate and that the information presented in the Stormwater Report accurately reflects conditions at the site as of the date of this permit application.



Registered Professional Engineer Block and Signature

Signature, Date

A handwritten signature in blue ink that reads "Elizabeth A. Mainini" followed by the date "5.22.17".

Massachusetts Stormwater Report Checklist

Project Type: Is the application for new development, redevelopment, or a mix of new and redevelopment?

- X New Development
- Redevelopment
- Mix of New Development and Redevelopment

LID Measures: Stormwater Standards require LID measures to be considered. Document what environmentally sensitive design and LID Techniques were considered during the planning and design of the project:

- X No disturbance to any Wetland Resource Areas
- Site Design Practices (e.g. clustered development, reduced frontage setbacks)
- Reduced Impervious Area (Redevelopment Only)
- Minimizing disturbance to existing trees and shrubs
- LID Site Design Credit Requested:
 - Credit 1
 - Credit 2
 - Credit 3
- X Use of “country drainage” versus curb and gutter conveyance and pipe
- Bioretention Cells (includes Rain Gardens)
- Constructed Stormwater Wetlands (includes Gravel Wetlands designs)
- Treebox Filter
- Water Quality Swale
- Grass Channel
- Green Roof
- X Other Roof recharge

Standard 1: No New Untreated Discharges

- X No new untreated discharges
- X Outlets have been designed so there is no erosion or scour to wetlands and waters of the Commonwealth
- X Supporting calculations specified in Volume 3 of the Massachusetts Stormwater Handbook included.

Standard 2: Peak Rate Attenuation

- Standard 2 waiver requested because the project is located in land subject to coastal storm flowage and stormwater discharge is to a wetland subject to coastal flooding.
- X Evaluation provided to determine whether off-site flooding increases during the 100-year 24-hour storm
- X Calculations provided to show that post-development peak discharge rates do not exceed pre-development rates for the 2-year and 10-year 24-hour storms. If evaluation shows that off-site flooding increases during the 100-year 24-hour storm, calculations are also provided to show that post-development peak discharge rates do not exceed pre-development rates for the 100-year 24-hour storm.

Massachusetts Stormwater Report Checklist

Standard 3: Recharge

- X Soil Analysis provided.
- X Required Recharge Volume calculation provided
- Required Recharge volume reduced through use of the LID site Design Credits.
- Sizing the infiltration, BMPs is based on the following method: Circle the method used.
- Static Simple Dynamic Dynamic Field³
- X Runoff from all impervious areas at the site discharging to the infiltration BMP.
- Runoff from all impervious areas at the site is *not* discharging to the infiltration BMP and calculations are provided showing that the drainage area contributing runoff to the infiltration BMPs is sufficient to generate the required recharge volume.
- X Recharge BMPs have been sized to infiltrate the Required Recharge Volume.
- Recharge BMPs have been sized to infiltrate the Required Recharge Volume *only* to the maximum extent practicable for the following reason:
- Site is comprised solely of C and D soils and/or bedrock at the land surface
 - M.G.L. c. 21E sites pursuant to 310 CMR 40.0000
 - Solid Waste Landfill pursuant to 310 CMR 19.000
 - Project is otherwise subject to Stormwater Management Standards only to the maximum extent practicable.
- X Calculations showing that the infiltration BMPs will drain in 72 hours are provided.
- Property includes a M.G.L. c. 21E site or a solid waste landfill and a mounding analysis is included.
- The infiltration BMP is used to attenuate peak flows during storms greater than or equal to the 10-year 24-hour storm and separation to seasonal high groundwater is less than 4 feet and a mounding analysis is provided.
- X Documentation is provided showing that infiltration BMPs do not adversely impact nearby wetland resource areas.

Standard 4: Water Quality

The Long-Term Pollution Prevention Plan typically includes the following:

- Good housekeeping practices;
- Provisions for storing materials and waste products inside or under cover;
- Vehicle washing controls;
- Requirements for routine inspections and maintenance of stormwater BMPs;
- Spill prevention and response plans;
- Provisions for maintenance of lawns, gardens, and other landscaped areas;
- Requirements for storage and use of fertilizers, herbicides, and pesticides;
- Pet waste management provisions;
- Provisions for operation and management of septic systems;
- Provisions for solid waste management;
- Snow disposal and plowing plans relative to Wetland Resource Areas;

³ 80% TSS removal is required prior to discharge to infiltration BMP if Dynamic Field method is used.

Massachusetts Stormwater Report Checklist

- Winter Road Salt and/or Sand Use and Storage restrictions;
 - Street sweeping schedules;
 - Provisions for prevention of illicit discharges to the stormwater management system;
 - Documentation that Stormwater BMPs are designed to provide for shutdown and containment in the event of a spill or discharges to or near critical areas or from LUHPPL;
 - Training for staff or personnel involved with implementing Long-Term Pollution Prevention Plan;
 - List of Emergency contacts for implementing Long-Term Pollution Prevention Plan.
- X A Long-Term Pollution Prevention Plan is attached to Stormwater Report and is included as an attachment to the Wetlands Notice of Intent.
- X Treatment BMPs subject to the 44% TSS removal pretreatment requirement and the one inch rule for calculating the water quality volume are included, and discharge:
 - is within the Zone II or Interim Wellhead Protection Area
 - is near or to other critical areas
 - is within soils with a rapid infiltration rate (greater than 2.4 inches per hour)
 - involves runoff from land uses with higher potential pollutant loads.
- The Required Water Quality Volume is reduced through use of the LID site Design Credits.
- Calculations documenting that the treatment train meets the 80% TSS removal requirement and, if applicable, the 44% TSS removal pretreatment requirement, are provided.
- X The BMP is sized (and calculations provided) based on:
 - X The $\frac{1}{2}$ " or 1" Water Quality Volume or
 - The equivalent flow rate associated with the Water Quality Volume and documentation is provided showing that the BMP treats the required water quality volume.
- The applicant proposes to use proprietary BMPs, and documentation supporting use of proprietary BMP and proposed TSS removal rate is provided. This documentation may be in the form of the propriety BMP checklist found in Volume 2, Chapter 4 of the Massachusetts Stormwater Handbook and submitting copies of the TARP Report, STEP Report, and/or other third party studies verifying performance of the proprietary BMPs.
- A TMDL exists that indicates a need to reduce pollutants other than TSS and documentation showing that the BMPs selected are consistent with the TMDL is provided.

Standard 5: Land Uses With Higher Potential Pollutant Loads (LUHPPLs)

- X The NPDES Multi-Sector General Permit covers the land use and the Stormwater Pollution Prevention Plan (SWPPP) has been included with the Stormwater Report.
- X The NPDES Multi-Sector General Permit covers the land use and the SWPPP will be submitted **prior to** the discharge of stormwater to the post-construction stormwater BMPs.
- The NPDES Multi-Sector General Permit does **not** cover the land use.
- LUHPPLs are located at the site and industry specific source control and pollution prevention measures have been proposed to reduce or eliminate the exposure of LUHPPLs to rain, snow, snow melt and runoff, and been included in the long term Pollution Prevention Plan.
- All exposure has been eliminated

Massachusetts Stormwater Report Checklist

- All exposure has **not** been eliminated and all BMPs selected are on MassDEP LUHPPL list.
- The LUHPPL has the potential to generate runoff with moderate to higher concentrations of oil and grease (e.g. all parking lots with >1000 vehicle trips per day) and the treatment train includes an oil grit separator, a filtering bioretention area, a sand filter or equivalent.

Standard 6: Critical Areas

- The discharge is near or to a critical area and the treatment train includes only BMPs that MassDEP has approved for stormwater discharges to or near that particular class of critical area.
- Critical areas and BMPs are identified in the Stormwater Report.

Standard 7: Redevelopments and Other Projects Subject to the Standards only to the maximum extent practicable

- X The project is subject to the Stormwater Management Standards only to the maximum Extent Practicable as a:
 - Limited Project
 - Small Residential Projects:
5-9 single family houses or 5-9 units in a multi-family development provided there is no discharge that may potentially affect a critical area.
 - 2-4 single family houses or 2-4 units in a multi-family development with a discharge to a critical area
 - Marina and/or boatyard provided the hull painting, service and maintenance areas are protected from exposure to rain, snow, snow melt and runoff
 - Bike Path and/or Foot Path
 - Redevelopment Project
 - Redevelopment portion of mix of new and redevelopment.
- Certain standards are not fully met (Standard No. 1, 8, 9, and 10 must always be fully met) and an explanation of why these standards are not met is contained in the Stormwater Report.
- The project involves redevelopment and a description of all measures that have been taken to improve existing conditions is provided in the Stormwater Report. The redevelopment checklist found in Volume 2 Chapter 3 of the Massachusetts Stormwater Handbook may be used to document that the proposed stormwater management system (a) complies with Standards 2, 3 and the pretreatment and structural BMP requirements of Standards 4-6 to the maximum extent practicable and (b) improves existing conditions.

Massachusetts Stormwater Report Checklist

Standard 8: Construction Period Pollution Prevention and Erosion and Sedimentation Control

A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan must include the following information:

- Narrative;
- Construction Period Operation and Maintenance Plan;
- Names of Persons or Entity Responsible for Plan Compliance;
- Construction Period Pollution Prevention Measures;
- Erosion and Sedimentation Control Plan Drawings;
- Detail drawings and specifications for erosion control BMPs, including sizing calculations;
- Vegetation Planning;
- Site Development Plan;
- Construction Sequencing Plan;
- Sequencing of Erosion and Sedimentation Controls;
- Operation and Maintenance of Erosion and Sedimentation Controls;
- Inspection Schedule;
- Maintenance Schedule;
- Inspection and Maintenance Log Form.

- X A Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan containing the information set forth above has been included in the Stormwater Report.
- The project is highly complex and information is included in the Stormwater Report that explains why it is not possible to submit the Construction Period Pollution Prevention and Erosion and Sedimentation Control Plan with the application. A Construction Period Pollution Prevention and Erosion and Sedimentation Control has **not** been included in the Stormwater Report but will be submitted **before** land disturbance begins.
- The project is **not** covered by a NPDES Construction General Permit.
- The project is covered by a NPDES Construction General Permit and a copy of the SWPPP is in the Stormwater Report.
- X The project is covered by a NPDES Construction General Permit but no SWPPP been submitted. The SWPPP will be submitted BEFORE land disturbance begins.

Standard 9: Operation and Maintenance Plan

- X The Post Construction Operation and Maintenance Plan is included in the Stormwater Report and includes the following information:
 - Name of the stormwater management system owners;
 - Party responsible for operation and maintenance;
 - Schedule for implementation of routine and non-routine maintenance tasks;
 - Plan showing the location of all stormwater BMPs maintenance access areas;
 - Description and delineation of public safety features;
 - Estimated operation and maintenance budget; and
 - Operation and Maintenance Log Form.

Massachusetts Stormwater Report Checklist

- The responsible party is ***not*** the owner of the parcel where the BMP is located and the Stormwater Report includes the following submissions:
 - A copy of the legal instrument (deed, homeowner's association, utility trust or other legal entity) that establishes the terms of and legal responsibility for the operation and maintenance of the project site stormwater BMPs;
 - A plan and easement deed that allows site access for the legal entity to operate and maintain BMP functions.

Standard 10: Prohibition of Illicit Discharges

- X The Long-Term Pollution Prevention Plan includes measures to prevent illicit discharges;
- X An Illicit Discharge Compliance Statement is attached;
- NO Illicit Discharge Compliance Statement is attached but will be submitted ***prior to*** the discharge of any stormwater to post-construction BMPs.

**WEEKLY
Inspection and Maintenance Log
AFTER CONSTRUCTION**

FOR: w2658
& After 0.5" Rain

Components		Date
Forebay Area Basin#1&2 - twice a year		
Comments during insp.		
Note corrective measures performed & Date		
Stormceptor prior to Basin#1 -twice a year		
Comments during insp.		
Note corrective measures performed & date		
Catch Basins - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Basin#1 outlet - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Inverts at Headwalls - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Inspector _____	Title _____	Date _____
Address _____	Tel# _____	

**WEEKLY
Inspection and Maintenance Log
AFTER CONSTRUCTION**

FOR: w2658
& After 0.5" Rain

Components	Date
Notify Cons. Comm. Issues effecting Resource Areas	
Comments during insp.	
Note corrective measures performed & date	
Illicit Drainage	
Discharge –	
Comments during insp.	
Note corrective measures performed & date	
Access to basin area	
– twice a year	
Comments during insp.	
Note corrective measures performed & date	
Any Spill Fuel, Chemical- as-needed	
Comments during insp.	
Note corrective measures performed & date	
Infiltration Basin#1&2	
-Once a year	
Comments during insp.	
Note corrective measures performed & date	
Crush Stone Aprons at outlets	
-Twice a year and replenish stone as needed	
Comments during insp.	
Note corrective measures performed & date	
Inspector _____	Title _____
Date _____	

**WEEKLY
Inspection and Maintenance Log FOR: w2658
AFTER CONSTRUCTION & After 0.5" Rain**

	Address	Tel#	
Components			Date
Comments during insp.			
Outlet Pipe Basin#1 -twice a year			
Comments during insp.			
Note corrective measures performed & date			
Comments during insp.			
Note corrective measures performed & date			
Outlet Pipe Basin#3 - twice a year			
Comments during insp.			
Note corrective measures performed & date			
Inspector	Title	Date	

Supporting Calculations

Forbay#1 Sizing Calculations:

Total drainage area = 382,917 s.f.

Required volume

382,917 s.f.(0.1 inch)= 3,190 c.f.

Provided volume

9,813 c.f.

Forbay#2 Sizing Calculations:

Total drainage area = 373,817 s.f.

Required volume

373,817 s.f.(0.1 inch)= 3,115 c.f.

Provided volume

6,118 c.f.

- INSTRUCTIONS:**
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
 2. Select BMP from Drop Down Menu
 3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Location: (Basin#2) 6P

B	C	D	E	F
BMP ¹	TSS Removal Rate ¹	Starting TSS Load*	Amount Removed (C*D)	Remaining Load (D-E)
Grass Channel	0.50	1.00	0.50	0.50
Tree Cover	0.80	0.50	0.40	0.10
Infiltration Basin	0.80	0.10	0.08	0.02
	0.00	0.02	0.00	0.02
	0.00	0.02	0.00	0.02
Total TSS Removal =				98%
Calculation Worksheet				Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: W-2658
 Prepared By: Peter M. Lavoie
 Date: 23-Aug-16

*Equals remaining load from previous BMP (E)
 which enters the BMP

**WEEKLY
Inspection and Maintenance Log
AFTER CONSTRUCTION**

FOR: w2658
& After 0.5" Rain

Components		Date
Forebay Area Basin#1&2 - twice a year		
Comments during insp.		
Note corrective measures performed & Date		
Stormceptor prior to Basin#1 -twice a year		
Comments during insp.		
Note corrective measures performed & date		
Catch Basins - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Basin#1 outlet - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Inverts at Headwalls - twice a year		
Comments during insp.		
Note corrective measures performed & date		
Inspector _____	Title _____	Date _____
Address _____	Tel# _____	

**WEEKLY
Inspection and Maintenance Log FOR: w2658
AFTER CONSTRUCTION & After 0.5" Rain**

Components	Date
Notify Cons. Comm. Issues effecting Resource Areas	
Comments during insp.	
Note corrective measures performed & date	
Illicit Drainage	
Discharge –	
Comments during insp.	
Note corrective measures performed & date	
Access to basin area – twice a year	
Comments during insp.	
Note corrective measures performed & date	
Any Spill Fuel, Chemical- -as-needed	
Comments during insp.	
Note corrective measures performed & date	
Infiltration Basin#1&2 -Once a year	
Comments during insp.	
Note corrective measures performed & date	
Crush Stone Aprons at outlets -Twice a year and replenish stone as needed	
Comments during insp.	
Note corrective measures performed & date	
Inspector _____ Title _____ Date _____	

**WEEKLY
Inspection and Maintenance Log
DURING CONSTRUCTION**

FOR: W2658
& After 0.5" Rain

Components	Date
Notify Cons. Comm. Issues effecting Resource Areas	
Comments during insp.	
Note corrective measures performed & date	
Silt of Public Streets – Daily	
Comments during insp.	
Note corrective measures performed & date	
Stockpile Materials	
Ring with Haybales – Weekly	
Comments during insp.	
Note corrective measures performed & date	
Any Spill Fuel, Chemical- Daily	
Comments during insp.	
Note corrective measures performed & date	
Temporary Ground Cover Area – Weekly	
Comments during insp.	
Note corrective measures performed & date	
Temporary Stone at Access Drive as Needed	
Comments during insp.	
Note corrective measures performed & date	
Inspector _____	Title _____
_____	Date _____

**WEEKLY
Inspection and Maintenance Log
DURING CONSTRUCTION**

FOR: W2658
& After 0.5" Rain

	Address	Tel#	
Components			Date
Lawn Area / Mulch Area			
Erosion, Washouts			
Comments during insp.			
Note corrective measures performed & date			
Stone Aprons at outlets as Needed			
Comments during insp.			
Note corrective measures performed & date			
Catch Basins as Needed			
Comments during insp.			
Note corrective measures performed & date			
Forebay Area as Needed			
Comments during insp.			
Note corrective measures performed & date			
Illicit Drainage Discharge			
Comments during insp.			
Note corrective measures performed & date			
	Inspector	Title	Date

Institute Village, MA

Feb. 1, 2017

G&H Project W-2658

Riprap Stone Sizing – Drainage Swale Outfalls

Method – ARS Rock Chutes (Slopes 2%-40%)

Reference: National Engineering Handbook, TS14C-8

#1 - Rock Apron-Basin 1 outlet (HydroCAD)

Slope = 0.028 ft/ft

q (100-yr) = 10.67 cfs

$$D_{50} = 12(1.923qS^{1.5})^{0.529}$$

D₅₀ = 4" required

D₅₀ = 6" provided

#2 - Rock Apron-Basin 1 outlet (HydroCAD)

Slope = 0.03 ft/ft

q (100-yr) = 6.30 cfs

$$D_{50} = 12(1.923qS^{1.5})^{0.529}$$

D₅₀ = 3" required

D₅₀ = 6" provided

Institute Village, MA

May 21, 2017

G&H Project W-2658

Forebay Calculations for Basin#1

Total Area = 382,219 s.f.

(0.1 inches x 382,219 s.f.)=3,185 c.f.

#Forebay Calculations for Basin#2

Total Area = 373,817 s.f.

(0.1 inches x 373,817 s.f.)=3,115 c.f.

Pipe Calculations

Job No. w2658
Lhuilliere & Hahn, Inc
1029 Providence Road
Whitinsville, MA 01588

DESIGN COMPUTATIONS FOR STORM DRAINS

Job No. w2658

Guerine & Hallon, Inc
1029 Providence Road
Whitinsville, MA 01588

DESIGN COMPUTATIONS FOR STORM DRAINS

Storm Influent T=50

2-Year 1.1

5-Year 1.4

10-Year 1.7

25-Year 2.0

50-Year 2.4

100-Year 2.5

Sheet No.: **Brook A - Bogs 1**

Storm Fre.: 25-Year

Date: 9/16/2016

Revised: 5/10/2017

Computed By: P Lavoie

Drainage Area	Stations or Manholes	Time of Concentration	Runoff Coefficient	Hydraulic Area	CxDn	I(CxDs)	Peak Flow Rate (cfs)	Peak Flow (cfs)	PROPOSED STORM DRAIN DATA						Invert Elevation ft = 0.013	Remarks		
									Pipe			Full Flow			Peak Flow			
									Box Culvert	Slope	Length	Capacity (ft³/s)	Velocity (ft/sec)	d/D	Time (min)			
From	To	min	C	acres	in	in/hr	(cfs)	(cfs)	Dia (in)	(ft)	(ft)	(ft³/s)	(ft/sec)	(ft)	Upper End	Lower End		
cb14	dmh8	13	0.47	0.840	0.39	0.69	4.69	1.85	12	0.0100	12	3.57	4.55	0.04	439.67	439.55		
cb15	dmh8	5	0.90	0.100	0.59	0.69	6.67	0.60	12	0.0100	19	3.57	4.55	0.05	439.67	439.45		
dmh8	dmh9	13	0.67	0.940	0.63	0.63	4.66	2.94	15	0.0260	182	1.044	8.51		437.80	433.07		
cb16	dmh9	15	0.46	0.680	0.31	0.31	4.43	1.39	12	0.0100	20	3.57	4.55	0.03	436.00	435.83		
cb17	dmh9	5	0.90	0.104	0.69	0.69	6.67	0.62	12	0.0100	20	3.57	4.55	0.06	435.00	435.80		
cb18	dmh9	5	0.90	0.104	0.69	0.69	6.67	0.62	12	0.0100	17	3.57	4.55	0.05	436.00	435.85		
cb18	dmh9	5	0.90	0.110	0.10	0.10	6.67	0.66	12	0.0100	30	3.57	4.55	0.09	436.00	435.70		
dmh9	dmh10	13	0.46	1.820	0.84	0.84	4.66	3.90	15	0.0140	130	1.66	6.45		432.90	431.08		
cb19	dmh10	5	0.90	0.140	0.13	0.13	6.67	0.84	12	0.0100	19	3.57	4.55	0.08	430.03	429.84		
cb29	dmh10	5	0.90	0.140	0.13	0.13	6.67	0.84	12	0.0100	12	3.57	4.55	0.17	430.03	429.9		
dmh10	dmh11	15	0.47	2.120	0.39	1.00	4.36	4.35	15	0.0120	88	7.10	5.78	0.23	428.90	427.84		
dmh11	dmh12	15	0.47	2.120	1.00	1.00	4.36	4.35	15	0.0320	174	1.58	9.44		423.50	417.92		
cb20	dmh12	5	0.90	0.120	0.11	0.11	6.57	0.71	12	0.0100	12	3.57	4.55	0.40	418.22	418.10		
cb21	dmh12	5	0.90	0.120	0.11	0.11	6.67	0.72	12	0.0100	19	3.57	4.55		418.22	418.05		
dmh12	dmh13	15	0.47	2.360	1.11	1.11	4.36	4.84	15	0.0360	190	12.25	10.01	0.23	412.00	405.16		
dmh13	dmh13	5	0.90	0.130	0.12	0.12	6.67	0.73	12	0.0100	12	5.77	4.55	0.04	406.10	405.98		
cb23	dmh13	5	0.90	0.130	0.12	0.12	6.67	0.73	12	0.0100	19	3.57	4.55	0.06	406.10	405.9		
dmh13	dmh14	15	0.65	2.560	1.66	1.55	4.36	7.26	15	0.0190	190	8.33	7.28	0.39	402.90	399.29		
cb24	dmh14	5	0.90	0.130	0.12	0.12	6.67	0.78	12	0.0100	12	3.57	4.55	0.06	401.27	401.15		
dmh14	dmh14	5	0.90	0.130	0.12	0.12	6.67	0.78	12	0.0100	19	3.57	4.55	0.06	401.27	401.03		
dmh15	dmh15	17	0.65	2.890	1.88	1.88	4.10	7.71	15	0.0190	166	13.93	7.28	0.31	399.24	396.09		
dmh15	dmh15	13	0.48	2.310	1.11	1.11	6.66	5.17	12	0.0260	140	16.98	9.61		395.75	392.1		
dmh15	dmh15	17	0.56	5.200	2.91	2.91	6.67	11.95	18	0.0260	140	10.01	9.35		388.90	387.85		
dmh15	dmh15	5	0.90	0.130	0.12	0.12	6.67	0.78	12	0.0100	19	3.57	4.55		394.26	394.07		
dmh15	dmh15	8	0.52	0.550	0.29	0.29	5.64	1.61	12	0.0100	12	3.57	4.55		394.26	394.14		
dmh15	dmh16	17	0.55	5.860	3.23	3.23	4.16	13.27	18	0.0190	155	14.52	8.22		392.00	389.05		
cb28	dmh16	8	0.55	1.040	0.57	0.57	4.70	3.26	12	0.0180	54	4.79	6.10		390.00	389.03		
dmh16	dmh17	17	0.55	6.884	3.79	3.79	4.10	15.54	24	0.0175	60	10.01	9.35					
dmh17	st1	17	0.55	6.884	3.79	3.79	4.10	15.54	24	0.0175	135	10.01	9.35		387.60	385.24		
st1	hw1	17	0.55	6.834	3.79	3.79	4.0	15.54	24	0.0175	26	10.01	9.35		385.00	384.55		
oc#1	hw1b	HYDRO CAD FILE					100gr	0.67	24	0.0150	31	27.78	8.84		372.00	371.54		

Lob No. W-2658

W 2658

Sturtever & Hainon, Inc.
2029 Providence Road
Wellesville, NY 14893

DESIGN COMPUTATIONS FOR STORM DRAINS

Drainage Area	Stations or Manholes	PROPOSED STORM DRAIN DATA												Remarks					
		Runoff Concentration				Tributary Area				Intensity (t)				n= 0.013	Peak Flow	Full Flow	Invert Elevation		
		Time of concentration	Coefficient	CDa	I(CDa)	Rainfall (in)	Intensity (in/hr)	Peak Flow (cfs)	Dia (ft)	Pipe Dia (in)	Box Culvert Dia (ft)	Slope (ft/ft)	Length (ft)	Capacity (ft/sec)	Velocity (ft/sec)	d/D	Time (min)		
cb32	cb32	dmh18	7	0.69	0.150	0.10	0.10	6.14	0.64	12		0.0100	18	3.87	4.35	0.32	0.57	448.30	448.12
cb33	cb33	dmh18	10	0.68	0.250	0.17	0.17	5.22	0.89	12		0.0100	8	3.57	4.35	0.44	0.36	448.30	448.22
dmh18	dmh18	dmh17	10	0.68	0.400	0.27	0.27	5.22	1.42	12		0.0368	23.9	6.85	8.73	0.32	0.57	448.30	448.20
cb30	cb30	dmh17	7	0.63	0.080	0.10	0.10	6.14	0.61	12		0.0100	18	3.57	4.35	0.32	0.57	441.56	441.38
cb31	cb31	dmh17	10	0.68	0.610	0.42	0.42	5.22	2.19	12		0.0100	8	3.57	4.35	0.34	0.44	441.56	441.48
dmh17	dmh19	dmh19	10	0.68	1.090	0.79	0.79	5.22	4.12	12		0.0225	164	6.03	7.38	0.32	0.38	439.10	439.41

Job No. W-2658

Job No. W-2658

Sturteverre & Hannon, Inc
2029 Providence Road
Thiells, NY 14588

DESIGN COMPUTATIONS FOR STORM DRAINS

PROPOSED STORM DRAIN DATA																				
Drainage Area	Stations or Manholes	Time of Concentration	Runoff Coefficient	tributary Area	CxDa	I(CxDa)	Peak Flow (ft³/hr)	Intensity (in/hr)	Pipe				Invert Elevation Upper End	Invert Elevation Lower End	Remarks					
									Front	To	Dia.	Box Culvert	Slope	Length	Capacity	Velocity	Peak Flow	d/D	Time	
									(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft/sec)	(ft/sec)	(ft)	(min)		
D11	D11	DMH1	13	0.48	1.430	0.75	0.75	4.83	3.52	12		0.0100	25	830	7.09	0.61	415.75	415.50		
CB1	CB1	DMH1	5	0.90	0.075	0.07	0.07	6.67	0.45	12		0.0100	12	630	8.03	4.02	415.71	415.59		
CB2	CB2	DMH1	5	0.90	0.075	0.07	0.07	6.67	0.45	12		0.0050	48	363	3.15	0.24	413.81	413.57		
DMH1	DMH2	DMH1	13	0.76	1.580	0.75	0.75	4.83	3.52	15		0.0100	30	648	5.98	5.41	413.53	412.05		
DMH2	DMH3	DMH3	13	0.76	1.580	0.75	0.75	4.83	3.52	15		0.0100	140	648	5.28	5.43	411.95	410.55		
CB3	CB3	DMH3	5	0.90	0.075	0.07	0.07	6.67	0.45	12		0.0100	12	630	8.03	4.02	417.38	417.26		
CB4	CB4	DMH3	5	0.90	0.075	0.07	0.07	6.67	0.45	12		0.0100	19	630	8.03	4.02	417.38	417.19		
DMH3	DMH4	DMH4	13	0.76	1.730	1.31	1.31	4.66	6.13	15		0.0170	185	648	5.98	6.11	410.45	409.31		
CB5	CB5	DMH4	5	0.90	0.110	0.09	0.09	6.67	0.50	12		0.0100	12	357	4.35	4.02	0.20	0.04	407.40	407.28
CB6	CB6	DMH4	5	0.90	0.110	0.09	0.09	6.67	0.50	12		0.0100	19	357	4.35	4.02	0.20	0.04	407.40	407.21
DMH4	DMH5A	DMH5A	13	0.48	1.950	0.93	0.93	4.83	4.59	15		0.0170	190	648	5.98	9.16	0.53	0.13	404.65	404.42
CB7	CB7	DMH5A	5	0.90	0.110	0.09	0.09	6.67	0.60	12		0.0100	12	357	4.35	4.02	0.20	0.04	401.63	401.51
CB8	CB8	DMH5A	5	0.90	0.110	0.09	0.09	6.67	0.50	12		0.0100	19	357	4.35	7.40	0.57	0.42	401.63	401.44
DMH5A	DMH5	DMH5	13	0.48	2.170	1.00	1.00	4.66	4.56	15		0.0170	167	648	5.98	9.16	0.43	0.30	399.15	398.31
CB9	CB9	DMH5	5	0.90	0.070	0.07	0.07	6.67	0.47	12		0.0100	12	357	4.35	4.02	0.20	0.04	396.64	396.52
CB10	CB10	DMH5	5	0.90	0.085	0.07	0.07	6.67	0.47	12		0.0100	19	357	4.35	4.02	0.20	0.04	396.64	396.45

DRAINAGE ANALYSIS

HydroCAD Calculations – Existing Conditions

PRE DEVELOPMENT

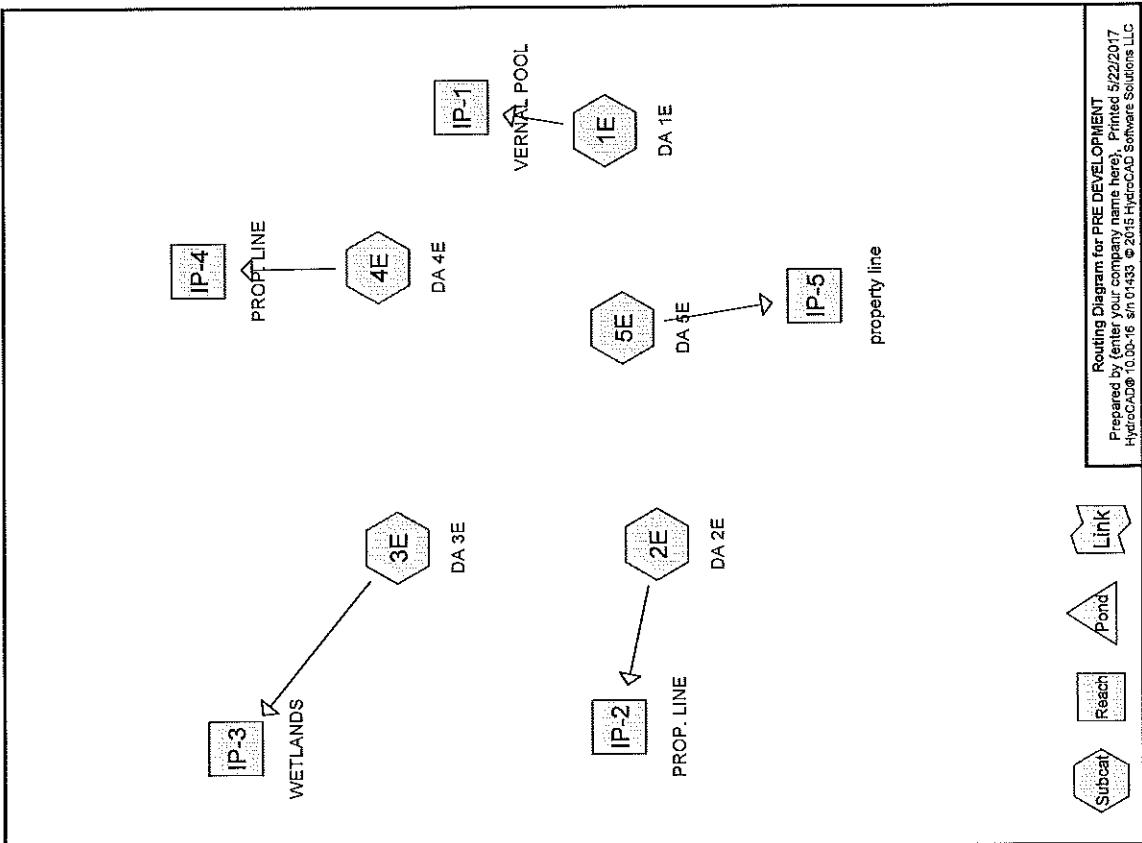
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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
6.981	61	>75% Grass cover, Good, HSG B (3E, 4E)
0.932	82	Dirt roads, HSG B (1E, 2E)
0.786	98	Paved parking & roofs (3E)
0.275	98	Water Surface, HSG B (4E)
1.782	55	Woods, Good, HSG B (5E)
46.518	58	Wood/grass comb., Good, HSG B (1E, 2E, 3E, 4E)



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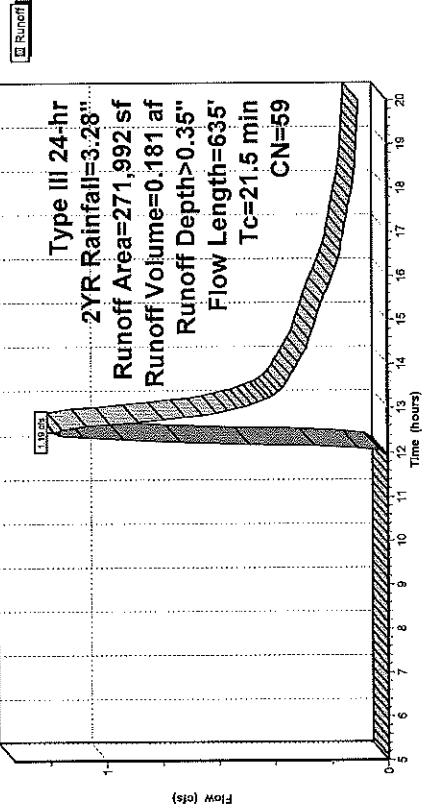
Type III 24-hr 2YR Rainfall=3.28"
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 Page 4

Summary for Subcatchment 1E: DA 1E

Runoff	=	1.19 cfs @ 12.46 hrs, Volume=	0.181 ac, Depth> 0.35"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs			
Type III 24-hr 2YR Rainfall=3.28"			
Area (sf)	CN	Description	
263,440	58	Woods/grass comb., Good, HSG B	
8552	82	Dirt roads, HSG B	
271,992	59	Weighted Average	
271,992		100.00% Pervious Area	
Tc	Length	Slope	Capacity
(min)	(feet)	(ft/ft)	(cfs)
12.3	50	0.0200	0.07
9.2	585	0.0450	1.06
21.5	635		Total

Subcatchment 1E: DA 1E

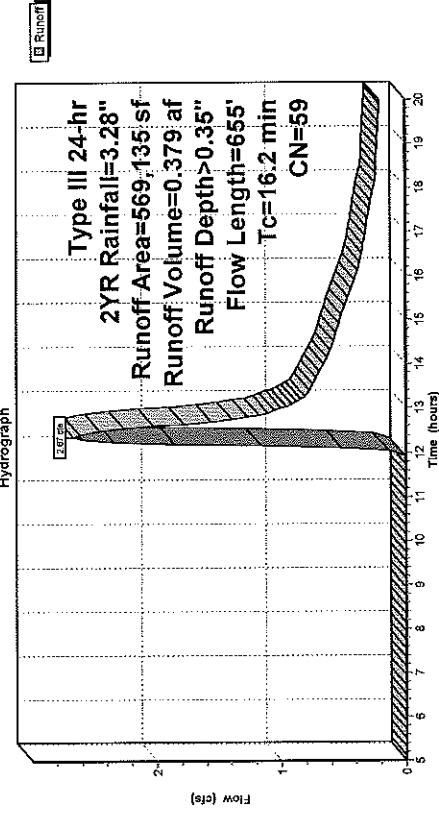
Hydrograph



Summary for Subcatchment 2E: DA 2E

Runoff	=	2.67 cfs @ 12.37 hrs, Volume=	0.379 ac, Depth> 0.35"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs			
Type III 24-hr 2YR Rainfall=3.28"			
Area (sf)	CN	Description	
537,109	58	Woods/grass comb., Good, HSG B	
32,026	82	Dirt roads, HSG B	
569,135	59	Weighted Average	
569,135		100.00% Pervious Area	
Tc	Length	Slope	Capacity
(min)	(feet)	(ft/sec)	(cfs)
9.9	30	0.0300	0.05
6.3	625	0.1100	1.66
16.2	655		Total

Subcatchment 2E: DA 2E



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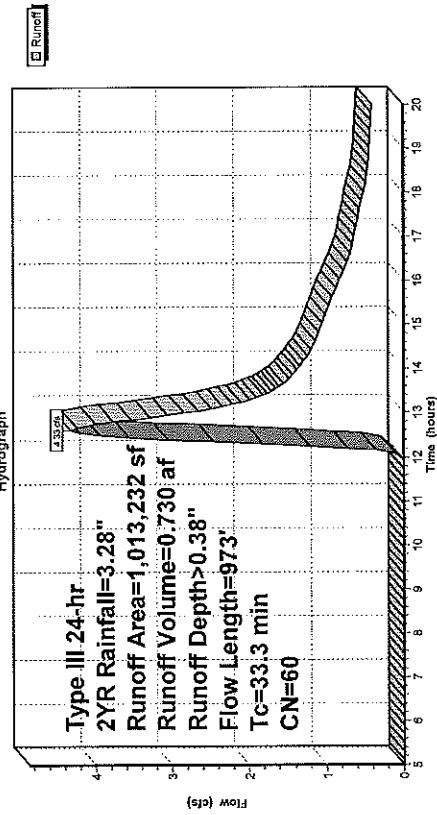
Type III 24-hr 2YR Rainfall=3.28"
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 Page 5

Summary for Subcatchment 3E: DA 3E

Runoff = 4.33 cfs @ 12.62 hrs, Volume= 0.730 af, Depth> 0.38"
 Runoff by SCS TR-20 method UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2YR Rainfall=3.28"

Tc	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B	
10.5	777	0.0610	1.23	Woods: Dense underbrush n= 0.800 P2= 3.20' Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps	
1.3	146	0.0360	1.90	Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Untilled Kv= 10.0 fps	
33.3	973	Total			

Subcatchment 3E: DA 3E



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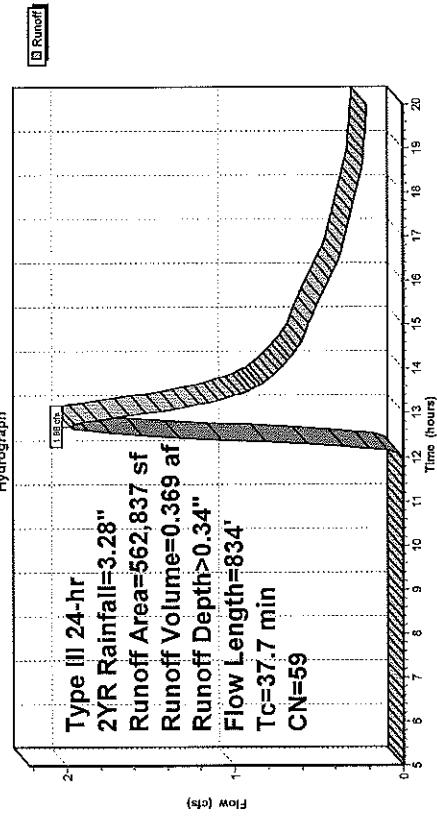
Type III 24-hr 2YR Rainfall=3.28"
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 Page 6

Summary for Subcatchment 4E: DA 4E

Runoff = 1.98 cfs @ 12.70 hrs, Volume= 0.369 af, Depth> 0.34"
 Runoff by SCS TR-20 method UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2YR Rainfall=3.28"

Area (sf)	CN	Description			
692,936	58	Woods/grass comb., Good, HSG B			
34,219	98	Paved parking & roofs			
286,077	61	>75% Grass cover, Good, HSG B			
1,013,232	60	Weighted Average			
979,013	96.62%	PerVIOUS Area			
34,219	3.38%	Impervious Area			
Tc	Length (min)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	50	0.0100	0.03	Sheet Flow, TRAVEL PATH A TO B	
9.4	784	0.0770	1.39	Woods: Dense underbrush n= 0.800 P2= 3.20' Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps	
37.7	834	Total			

Subcatchment 4E: DA 4E



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Type III 24-hr 2YR Rainfall=3.28"
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 Page 7

Summary for Subcatchment 5E: DA 5E

Runoff = 0.19 cfs @ 12.50 hrs, Volume= 0.034 ac, Depth> 0.23"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2YR Rainfall=3.28"

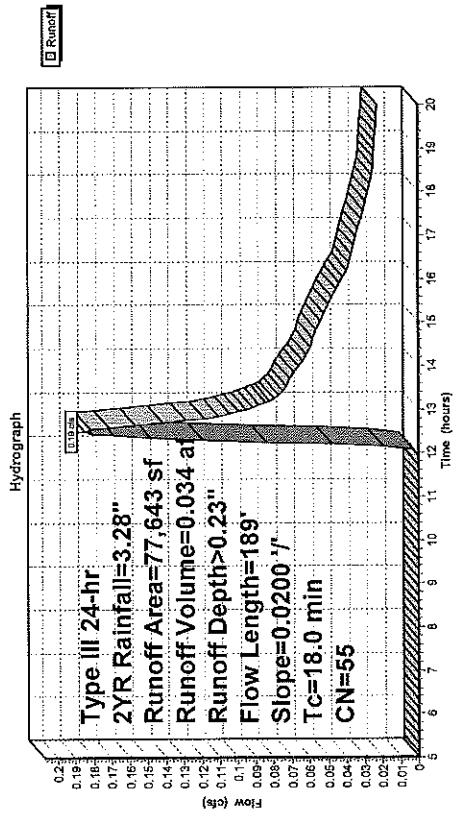
Area (sf)	CN	Description
77,643	55	Woods, Good, HSG B 100.00% Penous Area

Tc Length Slope Capacity Description
 (min) (feet) (ft/sec) (cfs)

Sheet Flow, TRAVEL PATH A TO B			
14.3	30	0.0200	0.04
Woods; Dense Underbrush n= 0.800 P2= 3.20"			
3.7	159	0.0200	0.71
Shallow Concentrated Flow, TRAVEL PATH Woodland Ky= 5.0 fps			

18.0 189 Total

Subcatchment 5E: DA 5E



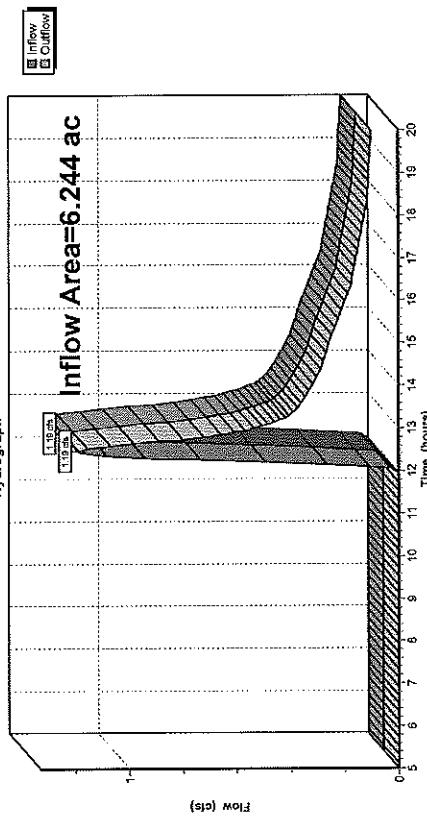
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Type III 24-hr 2YR Rainfall=3.28"
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 Page 8

Summary for Reach IP-1: VERNAL POOL

Inflow Area = 6.244 ac, 0.00% Impervious, Inflow Depth > 0.35" for 2YR event
 Inflow = 1.19 cfs @ 12.46 hrs, Volume= 0.181 ac
 Outflow = 1.19 cfs @ 12.46 hrs, Volume= 0.181 ac, Atten= 0%, Lag= 0.0 min
 Routing by StoI-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-1: VERNAL POOL



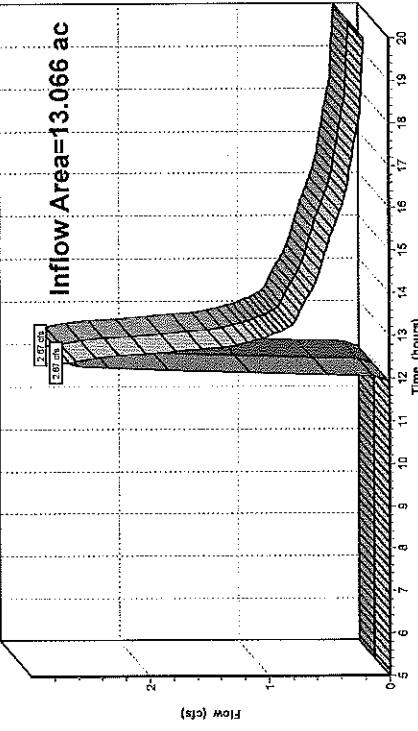
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HydroCAD® 10.00-16 s/n 01433 © 2015 HydroCAD Software Solutions LLC**Type III 24-hr 2YR Rainfall/=3.28"**Printed 5/22/2017
Page 9**Summary for Reach IP-2: PROP. LINE**

Inflow Area = 13.066 ac, 0.00% Impervious, Inflow Depth > 0.35" for 2YR event
Inflow = 2.67 cfs @ 12.37 hrs, Volume= 0.379 af
Outflow = 2.67 cfs @ 12.37 hrs, Volume= 0.379 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-2: PROP. LINE

Hydrograph

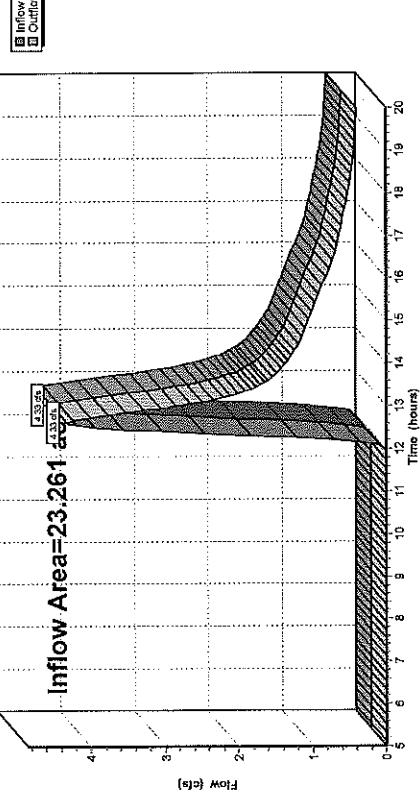
**PRE DEVELOPMENT**Prepared by {enter your company name here}
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Page 10**Summary for Reach IP-3: WETLANDS**

Inflow Area = 23.261 ac, 3.38% Impervious, Inflow Depth > 0.38" for 2YR event
Inflow = 4.33 cfs @ 12.62 hrs, Volume= 0.730 af
Outflow = 4.33 cfs @ 12.62 hrs, Volume= 0.730 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-3: WETLANDS

Hydrograph



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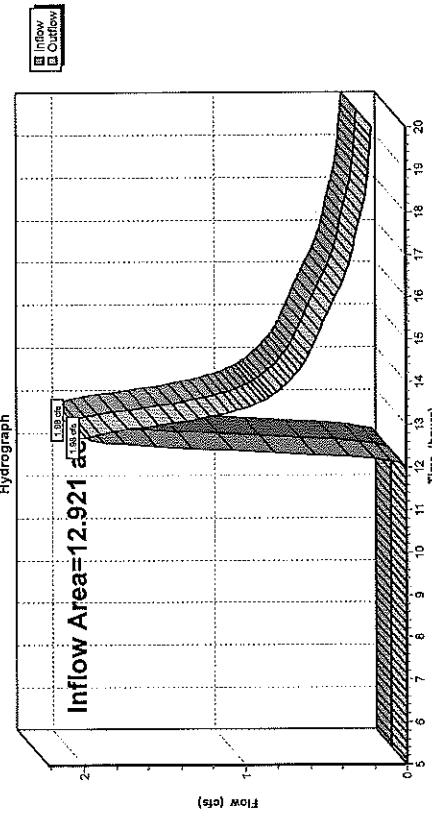
Type III 24-hr 2YR Rainfall=3.28"
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Page 11

Summary for Reach IP-4: PROP. LINE

Inflow Area = 12.921 ac, 2.13% Impervious, Inflow Depth > 0.34" for 2YR event
Inflow = 1.98 cfs @ 12.70 hrs, Volume= 0.368 af, Attenuation= 0%, Lag= 0.0 min
Outflow = 1.98 cfs @ 12.70 hrs, Volume= 0.369 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-4: PROP. LINE



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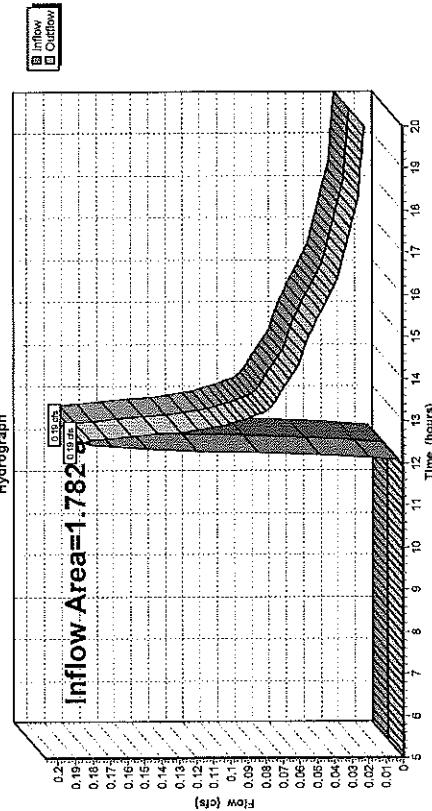
Type III 24-hr 2YR Rainfall=3.28"
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Page 12

Summary for Reach IP-5: property line

Inflow Area = 1.782 ac, 0.00% Impervious, Inflow Depth > 0.23" for 2YR event
Inflow = 0.19 cfs @ 12.50 hrs, Volume= 0.034 af, Attenuation= 0%, Lag= 0.0 min
Outflow = 0.19 cfs @ 12.50 hrs, Volume= 0.034 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-5: property line



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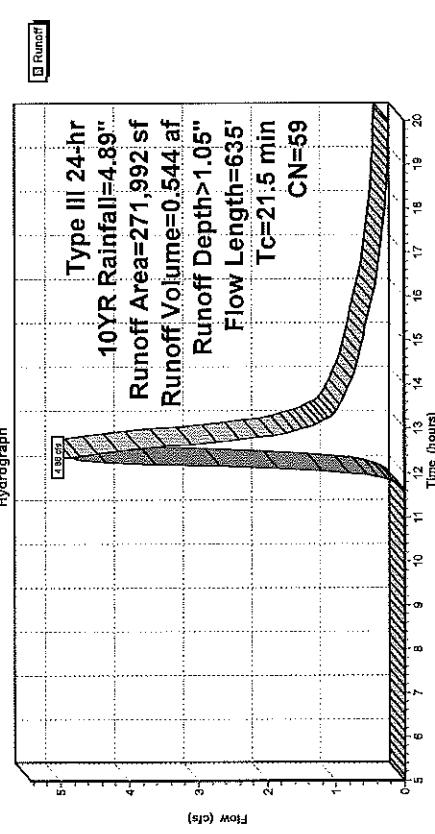
Summary for Subcatchment 1E: DA 1E

Runoff = 4.86 cfs @ 12.35 hrs, Volume= 0.544 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR Rainfall=4.89"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07	Sheet Flow, TRAVEL PATH A TO B Woods: Light underbrush n= 0.400 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kt= 5.0 ips	
9.2	585	0.0450	1.06		
21.5	635	Total			

Subcatchment 1E: DA 1E



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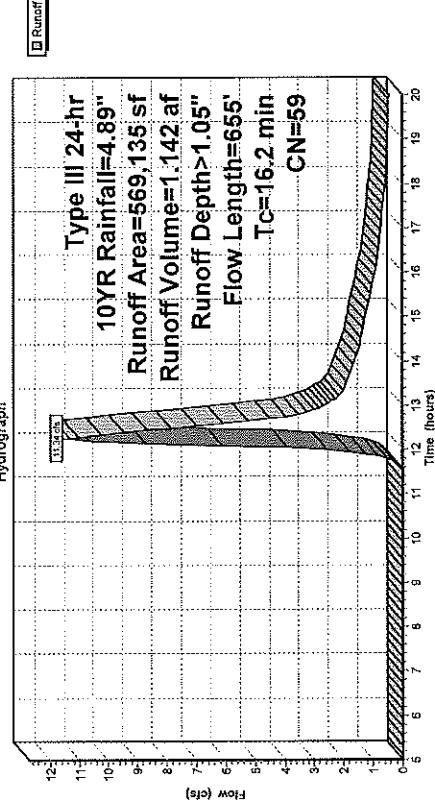
Summary for Subcatchment 2E: DA 2E

Runoff = 11.34 cfs @ 12.26 hrs, Volume= 1.142 af, Depth> 1.05"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR Rainfall=4.89"

Area (sf)	CN	Description	Area (sf)	CN	Description
263,440	58	Woods/grass comb., Good, HSG B	537,108	58	Woods/grass comb., Good, HSG B
8,552	82	Dirt roads, HSG B	32,026	82	Dirt roads, HSG B
271,992	59	Weighted Average	569,135	59	Weighted Average
271,992	59	100.00% Previous Area	569,135	59	100.00% Previous Area
<hr/>					
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Slope (ft/ft)	Description
9.9	30	0.0500	0.05	Sheet Flow, TRAVEL PATH A TO B Woods: Dense underbrush n= 0.800 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kt= 5.0 ips	
16.2	655	Total			

Subcatchment 2E: DA 2E



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Type III 24-hr 10YR Rainfall=4.89"
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 Page 15

Summary for Subcatchment 3E: DA 3E

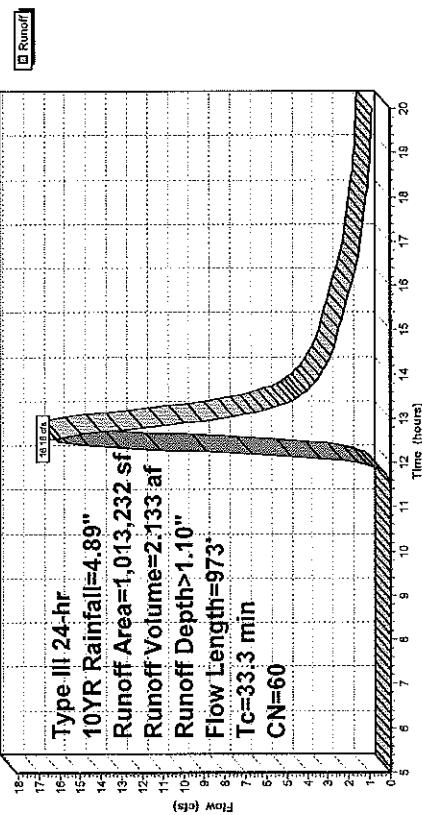
Runoff = 16.16 cfs @ 12.53 hrs, Volume= 2.133 af, Depth> 1.10"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR Rainfall=4.89"

Tc	Length (min)	Slope (feet/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B	
				Woods: Dense underbrush n=0.600 P2= 3.20"	
10.5	777	0.0610	1.23	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Woodland Kv= 5.0 fps	
1.3	146	0.0360	1.90	Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Nearly Bare & Untilled Kv= 10.0 fps	
33.3	973	Total			

Subcatchment 3E: DA 3E

Hydrograph



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Type III 24-hr 10YR Rainfall=4.89"
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 Page 16

Summary for Subcatchment 4E: DA 4E

Runoff = 7.88 cfs @ 12.60 hrs, Volume= 1.117 af, Depth> 1.04"

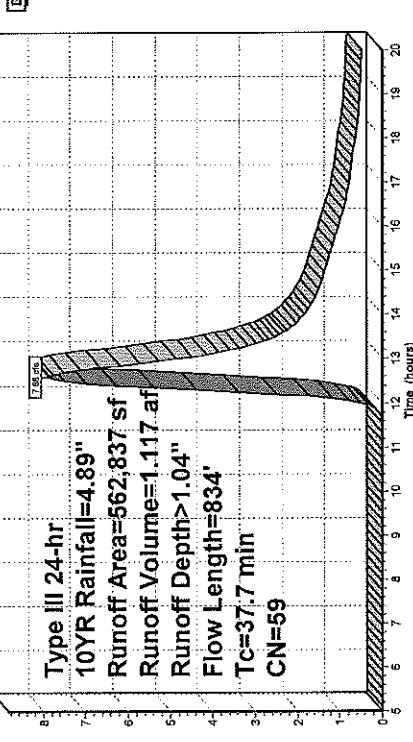
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR Rainfall=4.89"

Area (sf)	CN	Description
532.837	58	Woods/grass comb., Good, HSG B
12,000	98	Water Surface, HSG B
18,000	61	>75% Grass cover, Good, HSG B
532.837	59	Weighted Average
530.837	59	97.87% Perious Area
12,000		2.13% Impervious Area

Tc	Length (min)	Slope (feet/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.3	50	0.0100	0.03	Sheet Flow, TRAVEL PATH A TO B	
				Woods: Dense underbrush n= 0.800 P2= 3.20"	
9.4	784	0.0770	1.39	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Woodland Kv= 5.0 fps	
37.7	834	Total			

Subcatchment 4E: DA 4E

Hydrograph



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 Page 17

Summary for Subcatchment 5E: DA 5E

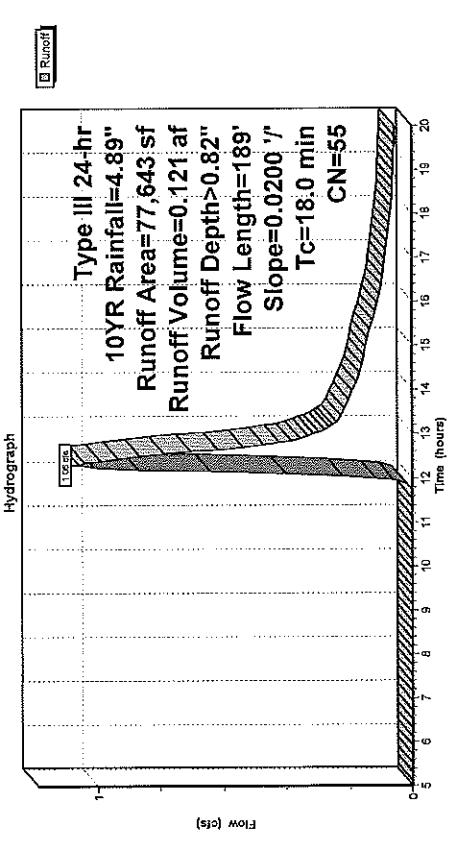
Runoff = 1.06 cfs @ 12.31 hrs, Volume= 0.121 ac, Depth> 0.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR Rainfall=4.89"

Area (sf)	CN	Description
77.643	55	Woods, Good HSG B
77.643		100.00% Previous Area

Tc	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	30	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B Woods: Dense underbrush n= 0.800 P2= 3.20'	
3.7	159	0.0200	0.71		Shallow Concentrated Flow, TRAVEL PATH Woodland Kv= 5.0 tps
18.0	189	Total			

Subcatchment 5E: DA 5E



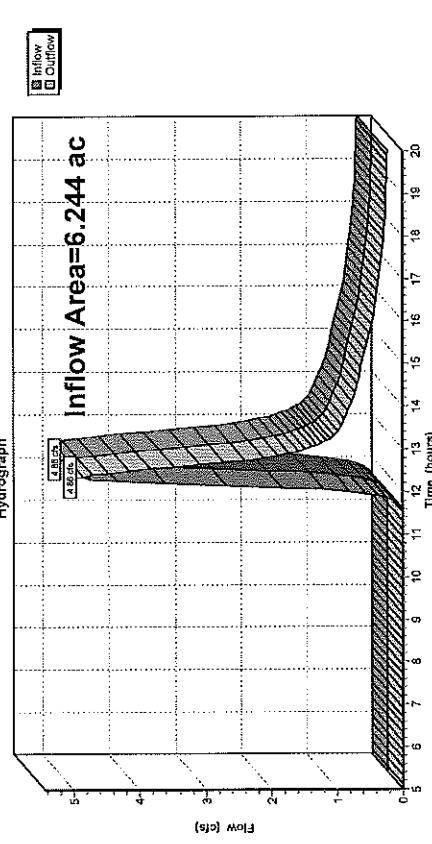
PRE DEVELOPMENT
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Type III 24-hr 10YR Rainfall=4.89"
 Printed 5/22/2017
 Page 18

Summary for Reach IP-1: VERNAL POOL

Inflow Area = 6.244 ac, 0.00% impervious, Inflow Depth > 1.05" for 10YR event
 Inflow = 4.86 cfs @ 12.35 hrs, Volume= 0.544 ac
 Outflow = 4.86 cfs @ 12.35 hrs, Volume= 0.544 ac, Atten= 0%, Lag= 0.0 min
 Routing by Sto:Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-1: VERNAL POOL



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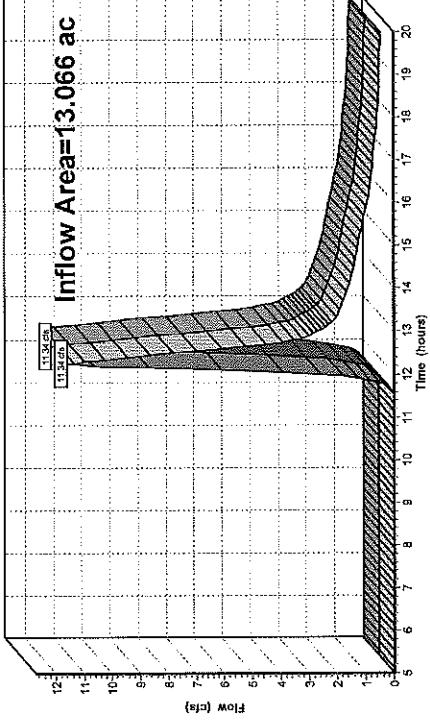
Type III 24-hr 10YR Rainfall=4.89"
Printed 5/22/2017
Page 19

Summary for Reach IP-2: PROP. LINE

Inflow Area = 13.066 ac, 0.00% Impervious, Inflow Depth > 1.05" for 10YR event
Inflow = 11.34 cfs @ 12.26 hrs, Volume= 1.142 af
Outflow = 11.34 cfs @ 12.26 hrs, Volume= 1.142 af, Atten=0%, Lag= 0.0 min
Routing by StoI-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-2: PROP. LINE

Hydrograph



Type III 24-hr 10YR Rainfall=4.89"
Printed 5/22/2017
Page 20

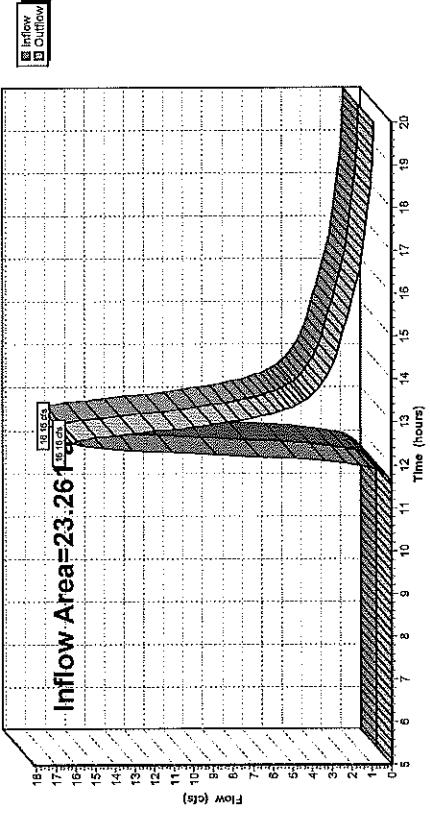
PRE DEVELOPMENT
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Summary for Reach IP-3: WETLANDS

Inflow Area = 23.261 ac, 3.38% Impervious, Inflow Depth > 1.10" for 10YR event
Inflow = 16.16 cfs @ 12.53 hrs, Volume= 2.133 af
Outflow = 16.16 cfs @ 12.53 hrs, Volume= 2.133 af, Atten=0%, Lag= 0.0 min
Routing by StoI-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-3: WETLANDS

Hydrograph



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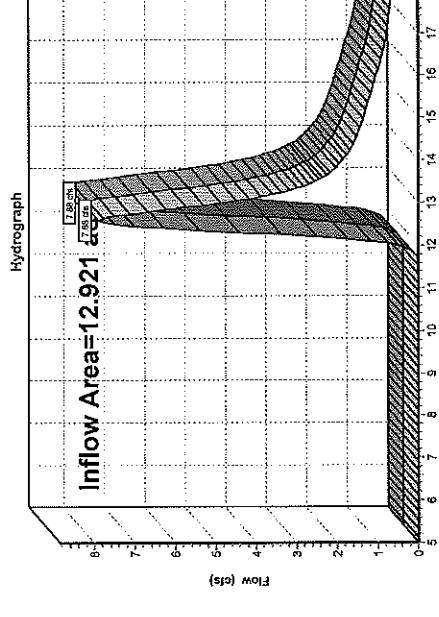
Type III 24-hr 10YR Rainfall=4.89"
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Summary for Reach IP-4: PROP. LINE

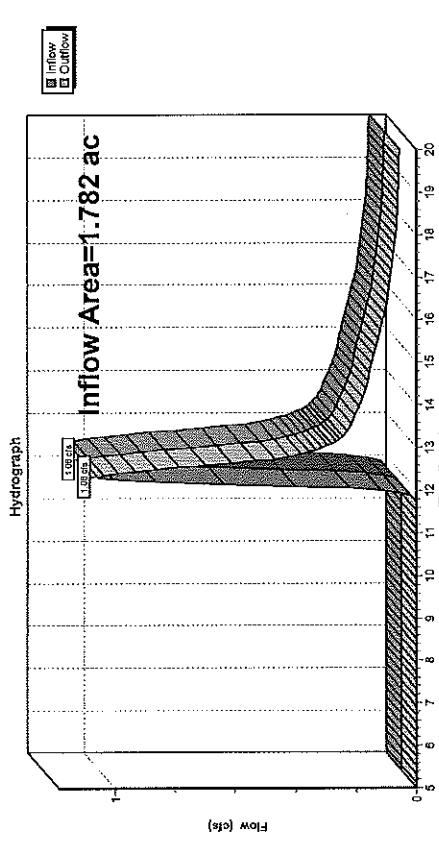
Inflow Area = 12.921 ac, 2.13% Impervious, Inflow Depth > 1.04" for 10YR event
Inflow = 7.88 cfs @ 12.60 hrs, Volume= 1.117 af, Lag= 0.0 min
Outflow = 7.88 cfs @ 12.60 hrs, Volume= 1.117 af, Attenuation= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-4: PROP. LINE



Reach IP-5: property line



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Type III 24-hr 10YR Rainfall=4.89"
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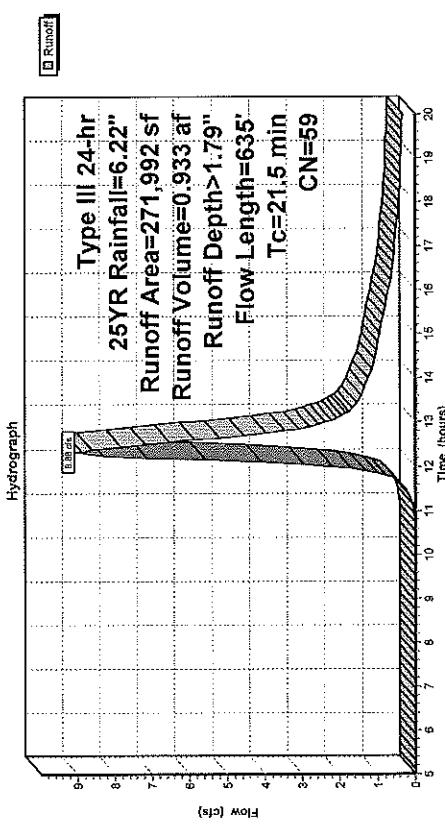
PRE DEVELOPMENT
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Type III 24-hr 25YR Rainfall=6.22"
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 Page 23

Summary for Subcatchment 1E: DA 1E

Runoff	=	8.88 cfs @ 12.32 hrs, Volume=	0.933 ac, Depth> 1.79"	
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs				
Type III 24-hr 25YR Rainfall=6.22"				
Area (sf)	CN	Description		
263,440	58	Woods/grass comb., Good, HSG B		
8,552	82	Dirt roads, HSG B		
271,992	59	Weighted Average		
271,992		100.00% Pervious Area		
Tc	Length	Slope	Capacity	Description
(min)	(feet)	(ft/sec)	(cfs)	
12.3	50	0.0200	0.07	Sheet Flow, TRAVEL PATH A TO B
				Woods: Light underbrush n= 0.400 F2= 3.20"
				Shallow Concentrated Flow, TRAVEL PATH B TO C
				Woodland Ku= 5.0 tps
21.5	635	Total		

Subcatchment 1E: DA 1E



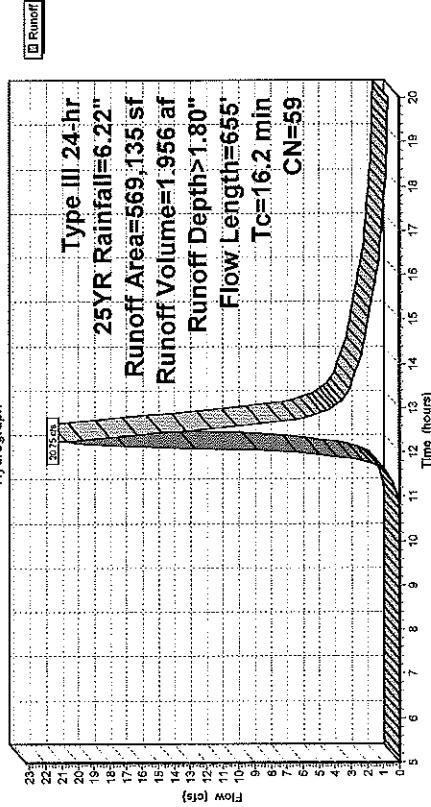
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Type III 24-hr 25YR Rainfall=6.22"
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 Page 24

Summary for Subcatchment 2E: DA 2E

Runoff	=	20.75 cfs @ 12.25 hrs, Volume=	1.956 ac, Depth> 1.80"	
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs				
Type III 24-hr 25YR Rainfall=6.22"				
Area (sf)	CN	Description		
537,109	58	Woods/grass comb., Good, HSG B		
32,026	82	Dirt roads, HSG B		
569,135	59	Weighted Average		
569,135		100.00% Pervious Area		
Tc	Length	Slope	Capacity	Description
(min)	(feet)	(ft/sec)	(cfs)	
9.9	30	0.0500	0.05	Sheet Flow, TRAVEL PATH A TO B
				Woods: Dense underbrush n= 0.800 F2= 3.20"
				Shallow Concentrated Flow, TRAVEL PATH B TO C
				Woodland Ku= 5.0 tps
16.2	655	Total		

Subcatchment 2E: DA 2E



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Type III 24-hr 25YR Rainfall=6.22"

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 Page 25

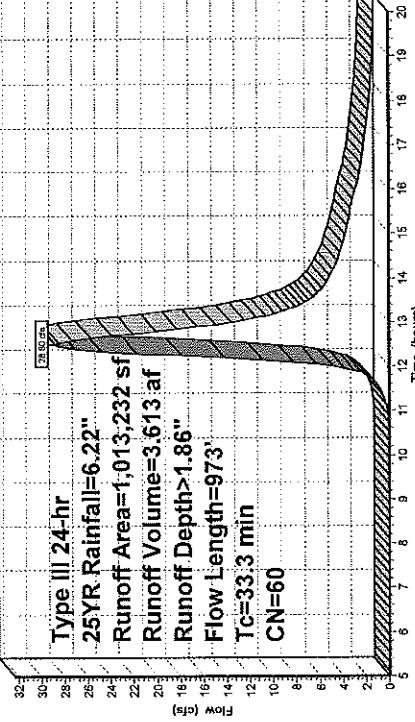
Summary for Subcatchment 3E: DA 3E

Runoff = 28.80 cfs @ 12.50 hrs, Volume=

3.613 af, Depth> 1.86"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR Rainfall=6.22"

Area (sf)	CN	Description
692,936	58	Woods/grass comb. Good, HSG B
34,219	98	Paved parking & roofs
286,077	61	>75% Grass cover, Good, HSG B
1,013,232	60	Weighted Average
979,013	96.62%	Previous Area
34,219	3.38%	Impervious Area

Tc	Length (min)	Slope (feet)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B	
10.5	777	0.0610	1.23	Woods: Dense underbrush n= 0.800 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 ips	
1.3	146	0.0360	1.90	Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Untilled Kv= 10.0 fps	
33.3	973	Total			

Subcatchment 3E: DA 3E**Hydrograph****PRE DEVELOPMENT**

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Type III 24-hr 25YR Rainfall=6.22"

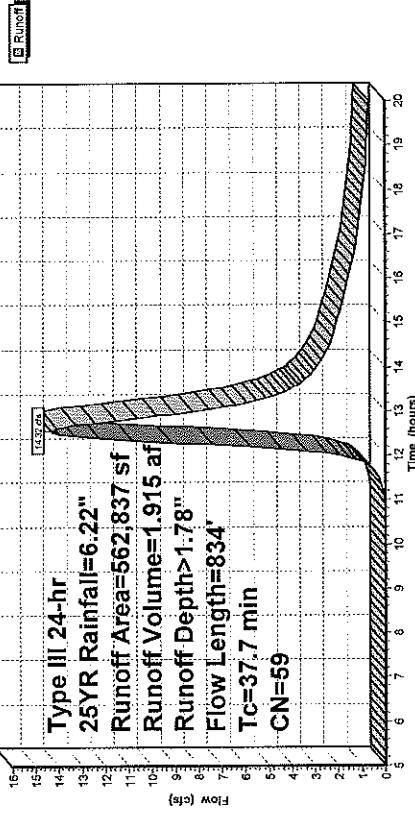
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 Page 25

Summary for Subcatchment 4E: DA 4E

Runoff = 14.32 cfs @ 12.57 hrs, Volume=

1.915 af, Depth> 1.78"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR Rainfall=6.22"

Area (sf)	CN	Description
532,837	58	Woods/grass comb., Good, HSG B
12,000	98	Water Surface, HSG B
18,000	61	>75% Grass cover, Good, HSG B
562,837	59	Weighted Average
550,837	97.87%	Previous Area
12,000	2.13%	Impervious Area

Subcatchment 4E: DA 4E**Hydrograph**

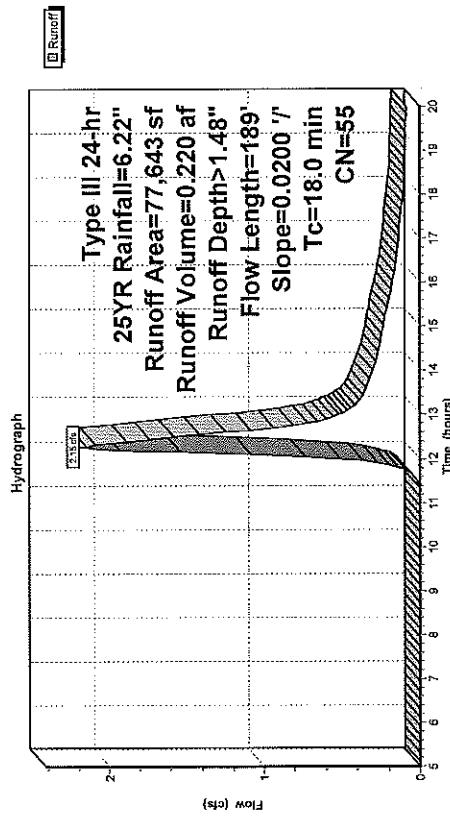
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Type III 24-hr 25YR Rainfall=6.22"
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 Page 27

Summary for Subcatchment 5E: DA 5E

Runoff	=	2.15 cfs @ 12.28 hrs, Volume=	0.220 af, Depth> 1.48"		
Runoff by SCS TR-20 method, UH=SOS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs					
Type III 24-hr 25YR Rainfall=6.22"					
Area (sf)	CN	Description			
77,643	55	Woods, Good, HSG B			
77,643		100.00% Pervious Area			
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(ft/ft)	(ft/sec)	(cfs)	
14.3	30	0.0200	0.04		Sheet Flow, TRAVEL PATH A TO B Woods: Dense underbrush n= 0.800 P2= 3.20' Shallow Concentrated Flow, TRAVEL PATH Woodland Kt= 5.0 fps
3.7	159	0.0200	0.71		
18.0	189	Total			

Subcatchment 5E: DA 5E



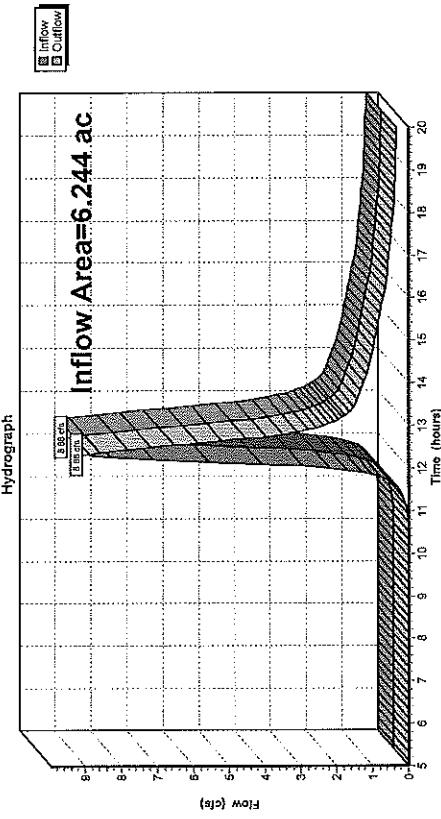
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Type III 24-hr 25YR Rainfall=6.22"
 Printed 5/22/2017
 Page 28

Summary for Reach IP-1: VERNAL POOL

Inflow Area = 6.244 ac, 0.00% Impervious, Inflow Depth > 1.79" for 25YR event
 Inflow = 8.88 cfs @ 12.32 hrs, Volume= 0.933 af
 Outflow = 8.88 cfs @ 12.32 hrs, Volume= 0.933 af, Attenu= 0%, Lag= 0.0 min
 Routing by Sto-Irnd+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-1: VERNAL POOL



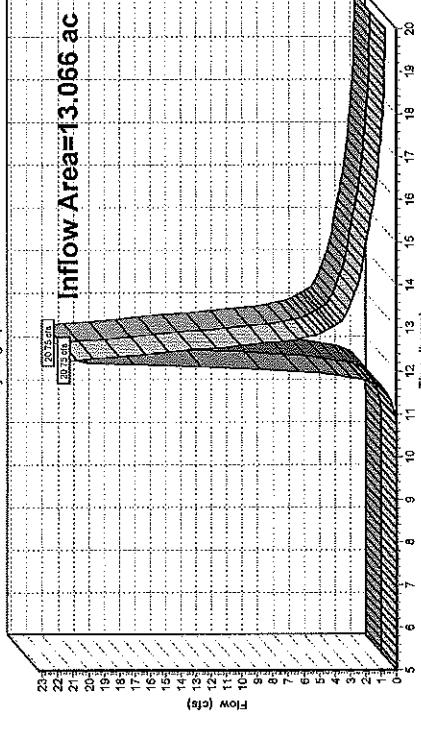
PRE DEVELOPMENTPrepared by [enter your company name here]
HydroCAD® 10.00-16 s/n 01433 © 2015 HydroCAD Software Solutions LLC**Type III 24-hr 25YR Rainfall=6.22"**Printed 5/22/2017
Page 29**Summary for Reach IP-2: PROP. LINE**

Inflow Area = 13.066 ac, 0.00% Impervious, Inflow Depth > 1.80" for 25YR event
Inflow = 20.75 cfs @ 12.25 hrs, Volume= 1.956 af
Outflow = 20.75 cfs @ 12.25 hrs, Volume= 1.956 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-2: PROP. LINE

Hydrograph

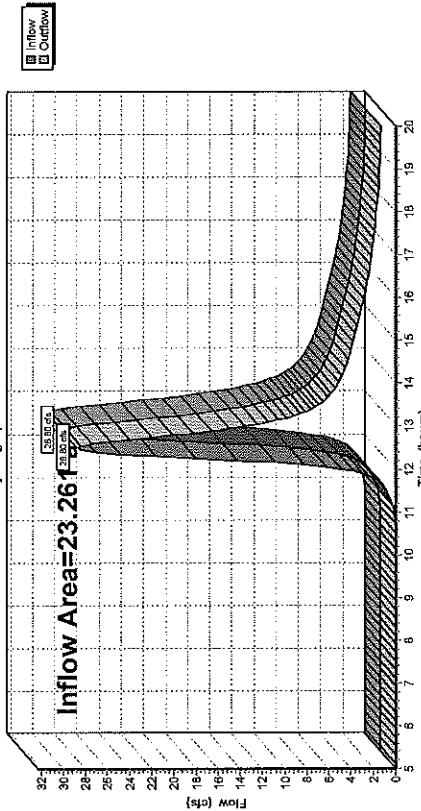
**PRE DEVELOPMENT**Prepared by [enter your company name here]
HydroCAD® 10.00-16 s/n 01433 © 2015 HydroCAD Software Solutions LLC**Type III 24-hr 25YR Rainfall=6.22"**Printed 5/22/2017
Page 30**Summary for Reach IP-3: WETLANDS**

Inflow Area = 23.261 ac, 3.38% Impervious, Inflow Depth > 1.86" for 25YR event
Inflow = 28.80 cfs @ 12.50 hrs, Volume= 3.613 af
Outflow = 28.80 cfs @ 12.50 hrs, Volume= 3.613 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-3: WETLANDS

Hydrograph



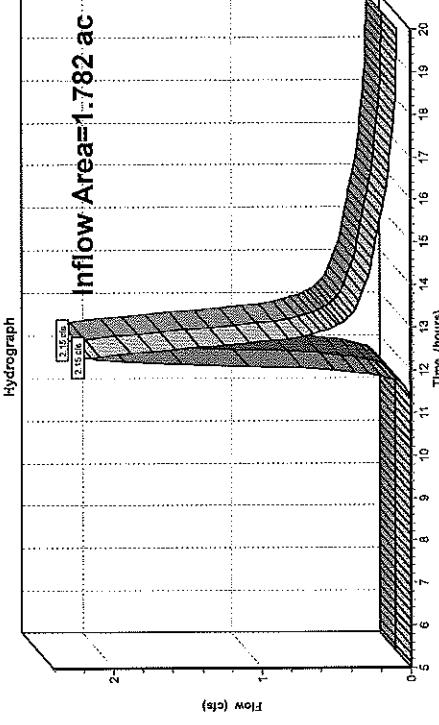
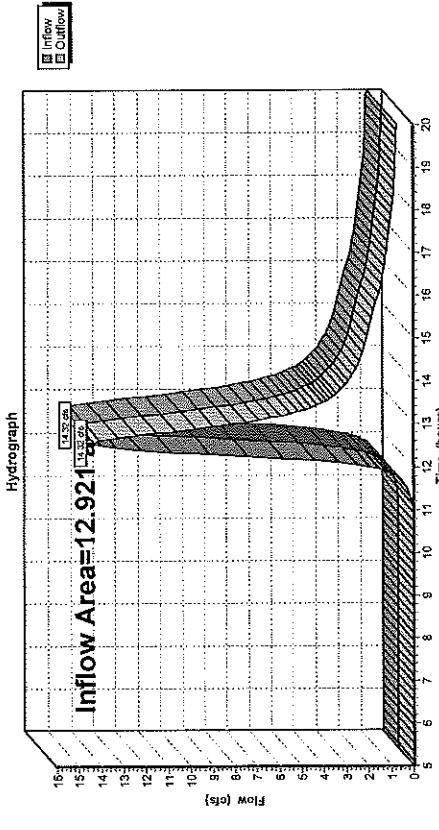
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Type III 24-hr 25YR Rainfall=6.22"
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Page 32

Summary for Reach IP-4: PROP. LINE

Inflow Area = 12.921 ac, 2.13% Impervious, Inflow Depth > 1.78" for 25YR event
Inflow = 14.32 cfs @ 12.57 hrs, Volume= 1.915 af
Outflow = 14.32 cfs @ 12.57 hrs, Volume= 1.915 af, Atten= 0%, Lag= 0.0 min
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-4: PROP. LINE



Summary for Reach IP-5: property line

Inflow Area = 1.782 ac, 0.00% Impervious, Inflow Depth > 1.48" for 25YR event
Inflow = 2.15 cfs @ 12.28 hrs, Volume= 0.220 af
Outflow = 2.15 cfs @ 12.28 hrs, Volume= 0.220 af, Atten= 0%, Lag= 0.0 min
Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-5: property line

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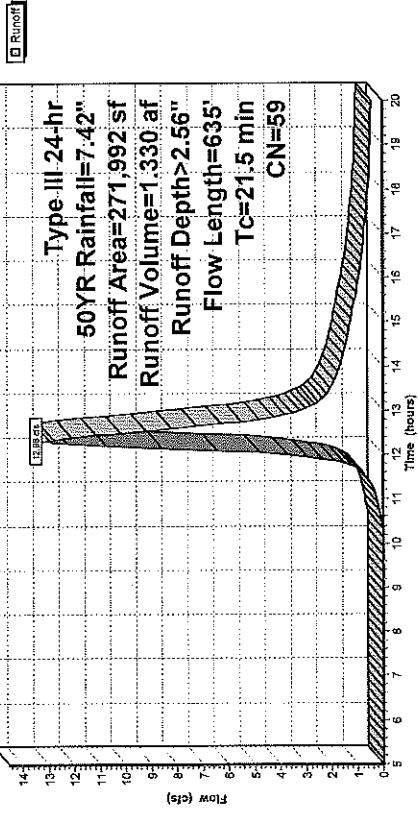
Type III 24-hr 50YR Rainfall=7.42"
 Printed 5/22/2017
 Page 33

Summary for Subcatchment 1E: DA 1E

Runoff	=	12.96 cfs @ 12.32 hrs, Volume=	1.330 af, Depth> 2.56"			
Runoff by SCS TR-20 method UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs						
Type III 24-hr 50YR Rainfall=7.42"						
Area (sf)	CN	Description				
263,440	58	Woods/grass comb., Good, HSG B				
8,552	82	Dirt roads, HSG B				
271,992	59	Weighted Average				
271,992		100.00% Previous Area				
(min)	Tc	Length	Slope	Velocity	Capacity	Description
	(feet)	(ft/ft)	(ft/sec)	(ft/sec)	(cfs)	
12.3	50	0.0200	0.07	Sheet Flow, TRAVEL PATH A TO B		
				Woods: Light underbrush n= 0.400	P2= 3.20"	
				Shallow Concentrated Flow, TRAVEL PATH B TO C		
				Woodland Kv= 5.0 fps		
21.5	635	Total				

Subcatchment 1E: DA 1E

Hydrograph



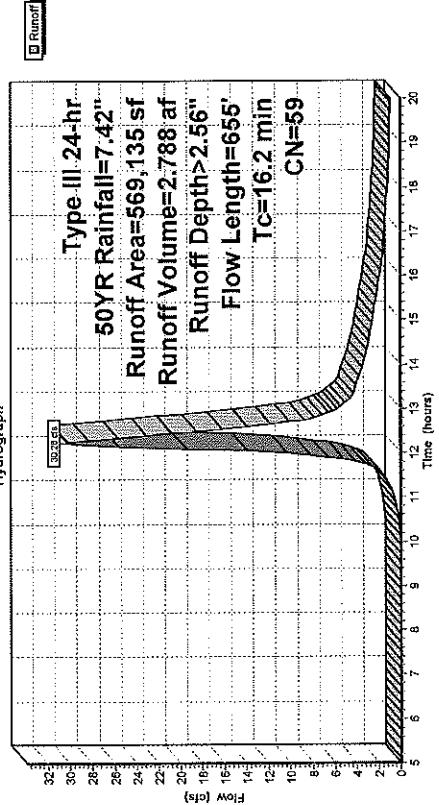
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Type III 24-hr 50YR Rainfall=7.42"
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 Page 34

Summary for Subcatchment 2E: DA 2E

Runoff	=	30.28 cfs @ 12.24 hrs, Volume=	2.788 af, Depth> 2.56"			
Runoff by SCS TR-20 method UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs						
Type III 24-hr 50YR Rainfall=7.42"						
Area (sf)	CN	Description				
537,109	58	Woods/grass comb., Good, HSG B				
32,026	82	Dirt roads, HSG B				
569,135	59	Weighted Average				
569,135		100.00% Previous Area				
(min)	Tc	Length	Slope	Velocity	Capacity	Description
	(feet)	(ft/ft)	(ft/sec)	(ft/sec)	(cfs)	
9.9	30	0.0500	0.05	Sheet Flow, TRAVEL PATH A TO B		
				Woods: Dense underbrush n= 0.800	P2= 3.20"	
				Shallow Concentrated Flow, TRAVEL PATH B TO C		
				Woodland Kv= 5.0 fps		
16.2	655	Total				

Subcatchment 2E: DA 2E



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Type III 24-hr 50YR Rainfall=7.42"

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Page 35

Summary for Subcatchment 3E: DA 3E

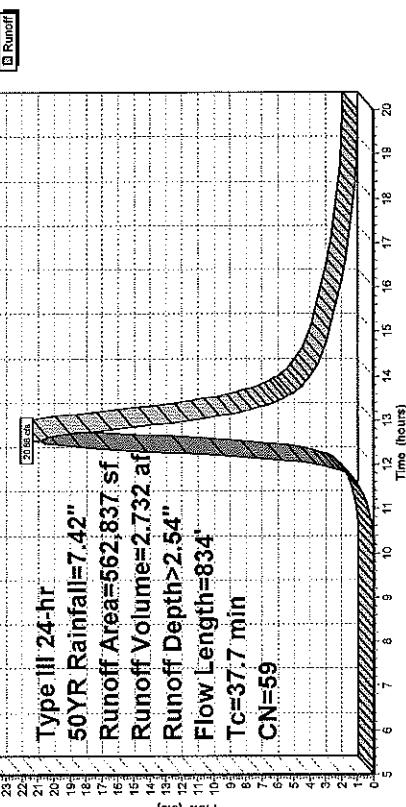
Runoff = 41.53 cfs @ 12.49 hrs, Volume= 5.118 af, Depth> 2.64"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50YR Rainfall=7.42"

Tc	Length (feet)	Slope (feet)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B Woods: Dense underbrush n= 0.800 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fps	
10.5	777	0.0610	1.23	Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Untitled Kv= 10.0 fps	
1.3	146	0.0360	1.90		
33.3	973	Total			

Subcatchment 3E: DA 3E

Hydrograph



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Type III 24-hr 50YR Rainfall=7.42"

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Page 36

Summary for Subcatchment 4E: DA 4E

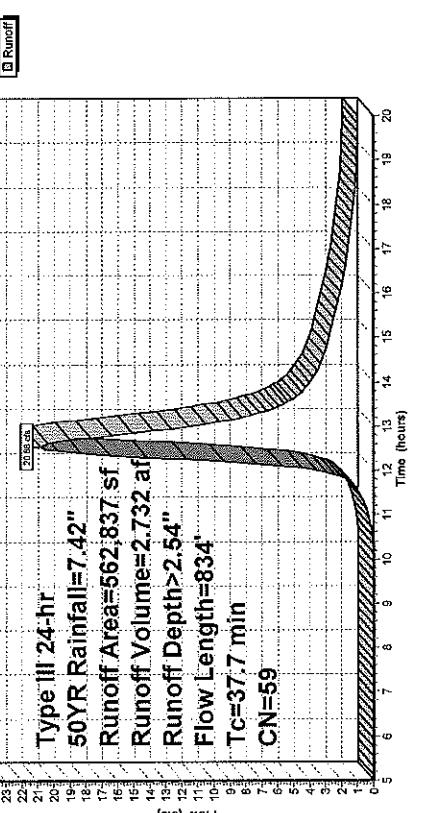
Runoff = 20.86 cfs @ 12.55 hrs, Volume= 2.732 af, Depth> 2.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50YR Rainfall=7.42"

Area (sf)	CN	Description
632.936	58	Woods/grass comb., Good, HSG B
34.219	98	Paved parking & roofs
266.077	61	>75% Grass cover, Good, HSG B
1,013.232	60	Weighted Average
979.013	96.52%	Pervious Area
34.218	3.38%	Impervious Area
37.7	834	Total

Subcatchment 4E: DA 4E

Hydrograph



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Page 37

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Page 38

Summary for Subcatchment 5E: DA 5E

Runoff = 3.30 cfs @ 12.27 hrs, Volume= 0.323 af, Depth> 2.17"

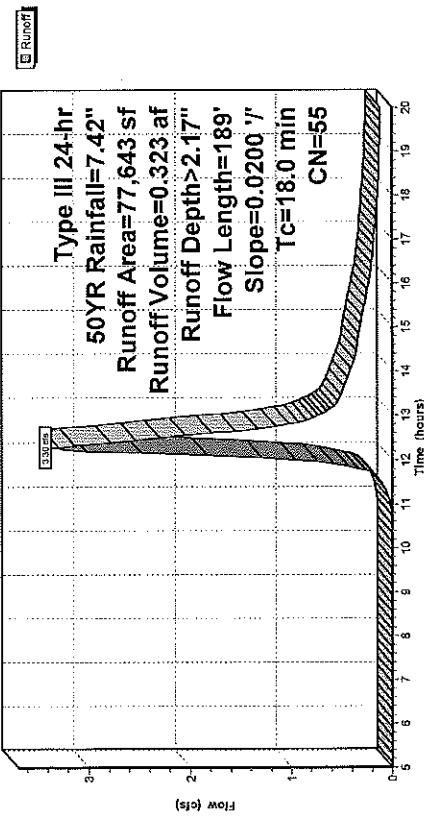
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 50YR Rainfall=7.42"

Area (sf)	CN	Description
77,643	55	Woods, Good, HSG B
77,643		100.00% PerVIOUS Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.3	30	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B Woods: Dense underbrush n= 0.800 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH Woodland Kv= 5.0 tps	
3.7	159	0.0200	0.71		
18.0	189	Total			

Subcatchment 5E: DA 5E

Hydrograph

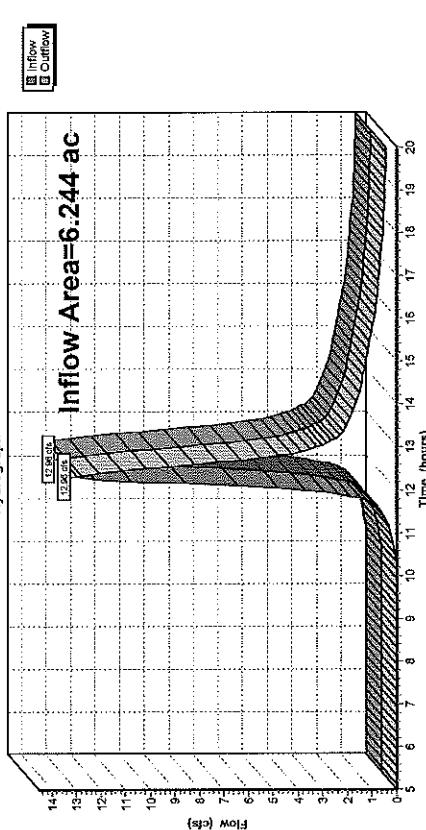
**Summary for Reach IP-1: VERNAL POOL**

Inflow Area = 6.244 ac, 0.00% Impervious, Inflow Depth > 2.56" for 50YR event
Inflow = 12.96 cfs @ 12.32 hrs, Volume= 1.330 af
Outflow = 12.96 cfs @ 12.32 hrs, Volume= 1.330 af, Atten= 0%, Lag= 0.0 min

Routing by Star-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-1: VERNAL POOL

Hydrograph



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Type III 24-hr 50YR Rainfall=7.42"

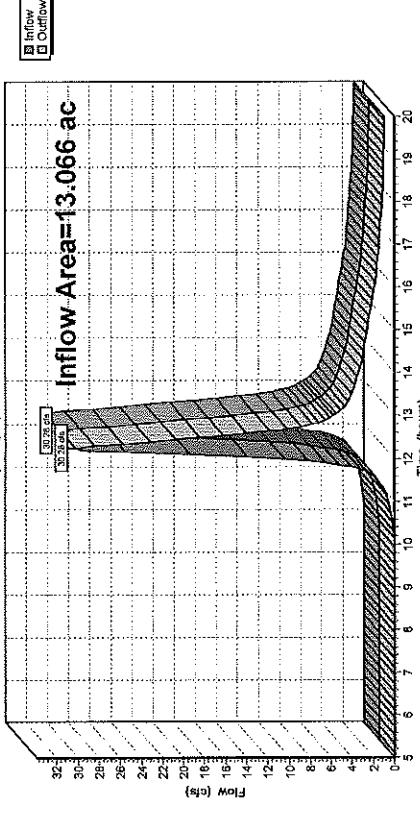
Printed 5/22/2017
Page 39**Summary for Reach IP-2: PROP. LINE**

Inflow Area = 13.066 ac, 0.00% Impervious, Inflow Depth > 2.56" for 50YR event
Inflow = 30.28 cfs @ 12.24 hrs, Volume= 2.788 af
Outflow = 30.28 cfs @ 12.24 hrs, Volume= 2.788 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-2: PROP. LINE

Hydrograph

**PRE DEVELOPMENT**Prepared by {enter your company name here}
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Type III 24-hr 50YR Rainfall=7.42"

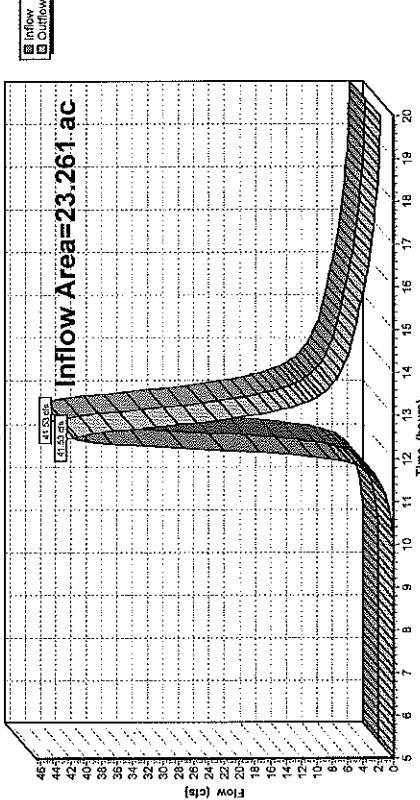
Printed 5/22/2017
Page 40**Summary for Reach IP-3: WETLANDS**

Inflow Area = 23.261 ac, 3.38% Impervious, Inflow Depth > 2.64" for 50YR event
Inflow = 41.53 cfs @ 12.49 hrs, Volume= 5.118 af
Outflow = 41.53 cfs @ 12.49 hrs, Volume= 5.118 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5:00-20:00 hrs, dt= 0.05 hrs

Reach IP-3: WETLANDS

Hydrograph



Type III 24-hr 50YR Rainfall=7.42"

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Page 41

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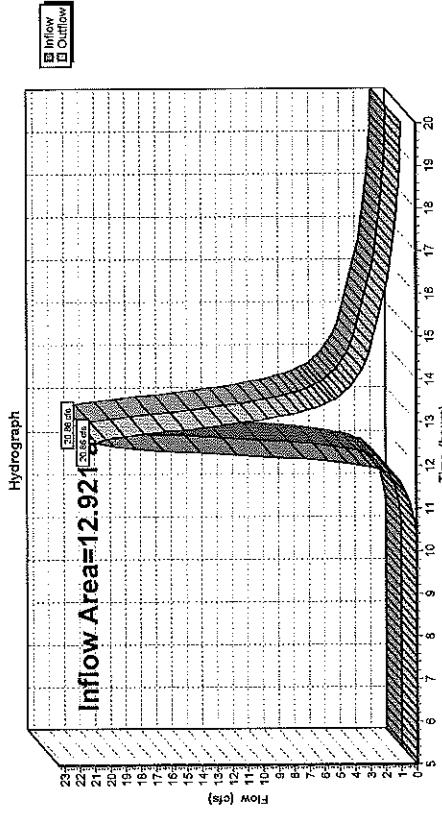
Type III 24-hr 50YR Rainfall=7.42"
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Page 41

Summary for Reach IP-4: PROP.LINE

Inflow Area = 12.921 ac, 2.13% Impervious, Inflow Depth > 2.54" for 50YR event
Inflow = 20.86 cfs @ 12.55 hrs, Volume= 2.732 af
Outflow = 20.86 cfs @ 12.55 hrs, Volume= 2.732 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-4: PROP. LINE



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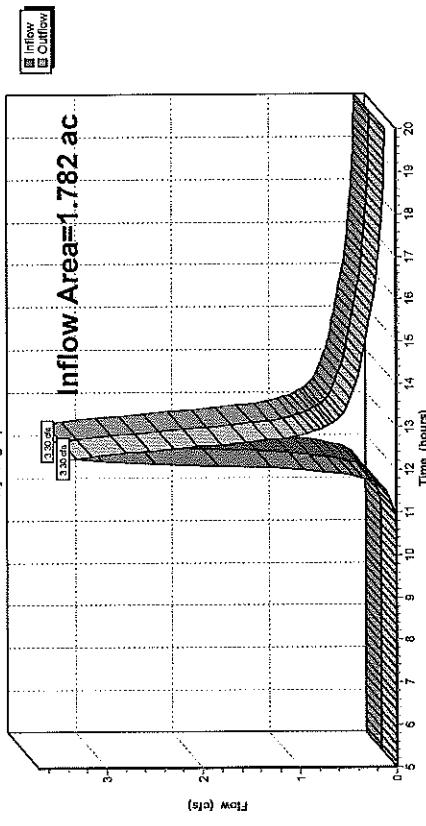
Type III 24-hr 50YR Rainfall=7.42"
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Page 42

Summary for Reach IP-5: property line

Inflow Area = 1.782 ac, 0.00% Impervious, Inflow Depth > 2.17" for 50YR event
Inflow = 3.30 cfs @ 12.27 hrs, Volume= 0.323 af
Outflow = 3.30 cfs @ 12.27 hrs, Volume= 0.323 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-5: property line



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Type III 24-hr 100YR Rainfall=8.84"
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Page 43

Summary for Subcatchment 1E: DA 1E

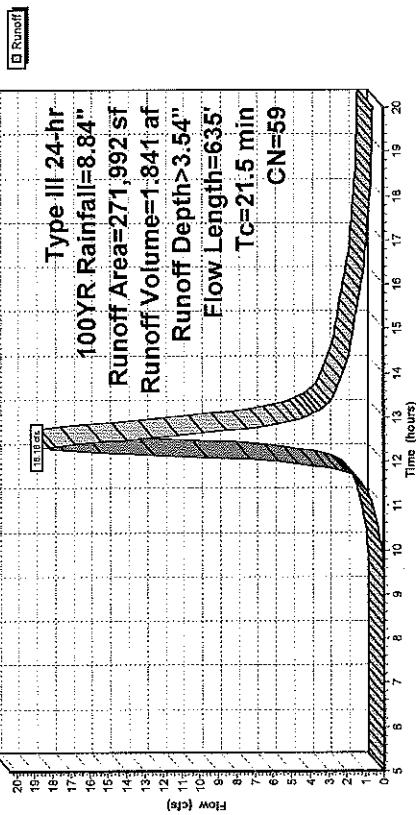
Runoff = 18.16 cfs @ 12.31 hrs, Volume= 1.841 af, Depth> 3.54"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.84"

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
12.3	50	0.0200	0.07	Sheet Flow, TRAVEL PATH A TO B	
9.2	585	0.0450	1.06	Woods: Light underbrush n= 0.400 P2= 3.20" Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 fips	
21.5	635	Total			

Subcatchment 1E: DA 1E

Hydrograph



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Type III 24-hr 100YR Rainfall=8.84"
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Page 44

Summary for Subcatchment 2E: DA 2E

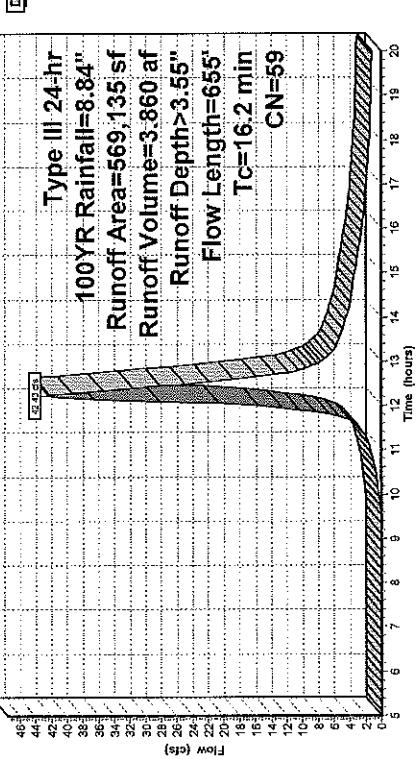
Runoff = 42.43 cfs @ 12.23 hrs, Volume= 3.860 af, Depth> 3.55"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR Rainfall=8.84"

Area (sf)	CN	Description
537,109	58	Woods/grass comb., Good, HSG B
32,026	82	Dirt roads, HSG B
569,135	59	Weighted Average
569,135	59	100.00% Pervious Area
16.2	Total	

Subcatchment 2E: DA 2E

Hydrograph



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Type III 24-hr 100YR Rainfall=8.84"

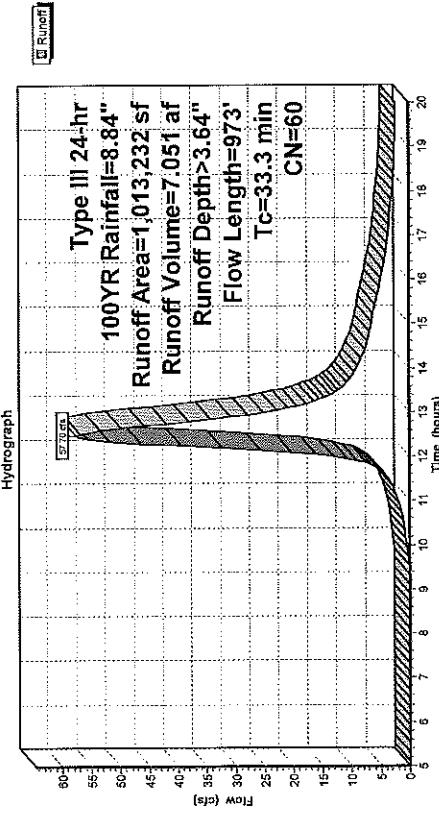
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 Page 45

Summary for Subcatchment 3E: DA 3E

Runoff	=	57.70 cfs @ 12.48 hrs, Volume=	7.051 af, Depth> 3.64"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs			
Type III 24-hr 100YR Rainfall=8.84"			
Tc	Length	Slope	Velocity Capacity Description
(min)	(feet)	(ft/sec)	(cfs)
21.5	50	0.0200	0.04
10.5	777	0.0610	1.23
1.3	146	0.0360	1.90
33.3	973		Total

Sheet Flow, TRAVEL PATH A TO B
 Woods: Dense underbrush n= 0.800 P2= 3.20"
 Shallow Concentrated Flow, TRAVEL PATH B TO C
 Woodland Kv= 5.0 fps
 Shallow Concentrated Flow, TRAVEL PATH C TO D
 Nearly Bare & Untitled Kv= 10.0 fps

Subcatchment 3E: DA 3E



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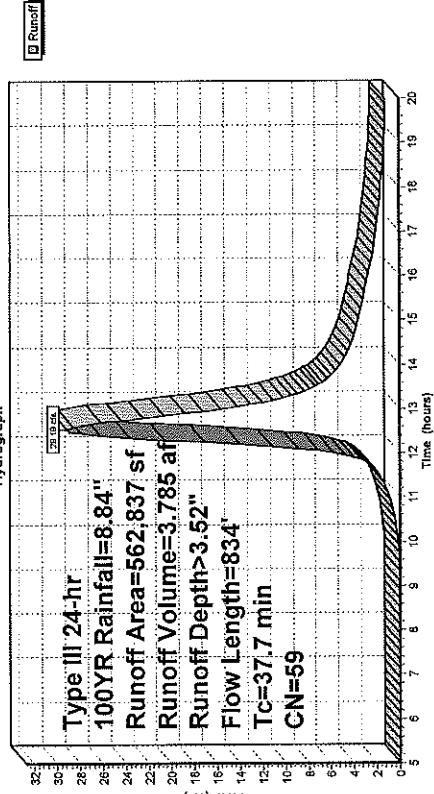
Type III 24-hr 100YR Rainfall=8.84"
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 Page 46

Summary for Subcatchment 4E: DA 4E

Runoff	=	29.19 cfs @ 12.54 hrs, Volume=	3.785 af, Depth> 3.52"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs			
Type III 24-hr 100YR Rainfall=8.84"			
Area (sf)	CN	Description	
692.936	58	Woods/grass comb, Good, HSG B	
34.219	98	Paved parking & roofs	
286.077	61	>75% Grass cover, Good, HSG B	
979.013	60	Weighted Average	
34.219		96.62% Perious Area	
979.013		3.38% Impervious Area	
Tc	Length	Slope	Velocity Capacity Description
(min)	(feet)	(ft/sec)	(cfs)
28.3	50	0.0100	0.03
9.4	784	0.0770	1.39
37.7	834	Total	

Sheet Flow, TRAVEL PATH A TO B
 Woods: Dense underbrush n= 0.800 P2= 3.20"
 Shallow Concentrated Flow, TRAVEL PATH B TO C
 Woodland Kv= 5.0 fps
 Shallow Concentrated Flow, TRAVEL PATH C TO D
 Woodland Kv= 5.0 fps

Subcatchment 4E: DA 4E



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Type III 24-hr 100YR Rainfall=8.84"

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 Page 47

Summary for Subcatchment 5E: DA 5E

Runoff = 4.79 cfs @ 12.26 hrs, Volume= 0.458 af, Depth> 3.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100YR Rainfall=8.84"

Area (sf) CN Description

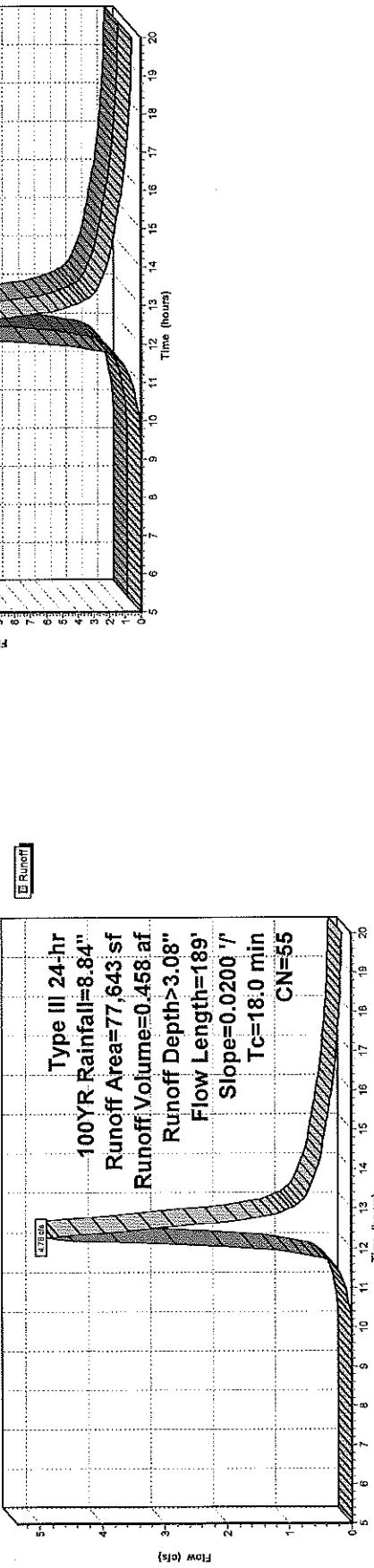
77,643	55	Woods, Good, HSG B
77,643		100.00% Pervious Area

Tc Length Slope Velocity Capacity Description
 (min) (feet) (ft/ft) (ft/sec) (cfs)

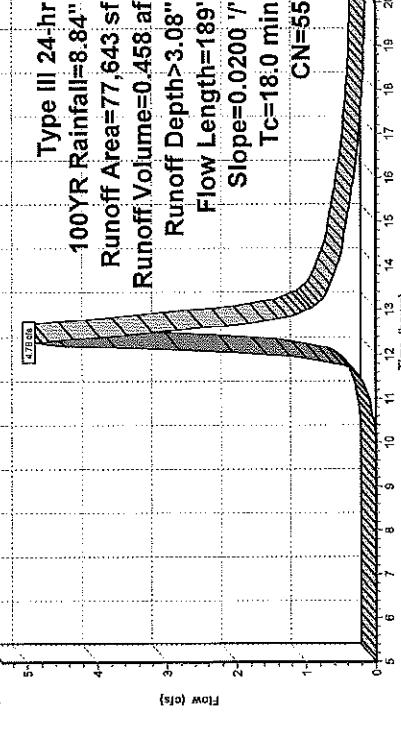
Area (sf)	CN	Description
14.3	30	0.0200 0.04 Sheet Flow, TRAVEL PATH A TO B Woods: Dense Underbrush n= 0.800 P2= 3.20° Shallow Concentrated Flow, TRAVEL PATH
3.7	159	0.0200 0.71 Woodland Kt= 5.0 fps
18.0	189	Total

Subcatchment 5E: DA 5E

Hydrograph



The hydrograph shows a sharp peak at 12 hours, reaching a maximum value of approximately 4.79 cfs. The area under the curve is shaded black.

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Type III 24-hr 100YR Rainfall=8.84"

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 Page 48

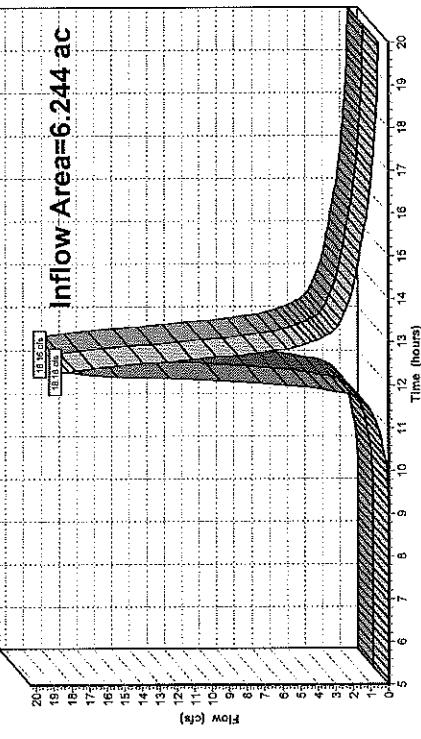
Summary for Reach IP-1: VERNAL POOL

Inflow Area = 6.244 ac, 0.00% Impervious, Inflow Depth > 3.54" for 100YR event
 Inflow = 18.16 cfs @ 12.31 hrs, Volume= 1.841 af
 Outflow = 18.16 cfs @ 12.31 hrs, Volume= 1.841 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-1: VERNAL POOL

Hydrograph



The hydrograph shows two curves: Inflow (top) and Outflow (bottom). Both curves show a sharp peak at 12.31 hours, with the inflow reaching approximately 18.16 cfs and the outflow reaching approximately 1.841 af. The area under the inflow curve is shaded black.

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Type III 24-hr 100YR Rainfall=8.84"
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Page 49

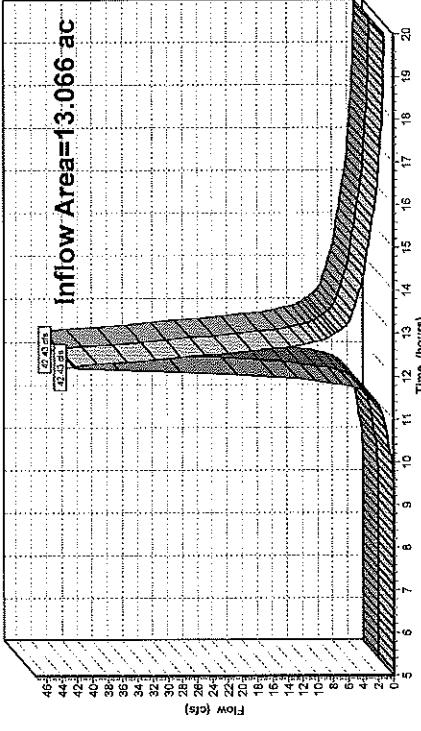
Summary for Reach IP-2: PROP. LINE

Inflow Area = 13.066 ac, 0.00% Impervious, Inflow Depth > 3.55" for 100YR event
Inflow = 42.43 cfs @ 12.23 hrs, Volume= 3.860 af
Outflow = 42.43 cfs @ 12.23 hrs, Volume= 3.860 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-2: PROP. LINE

Hydrograph



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Type III 24-hr 100YR Rainfall=8.84"
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Page 50

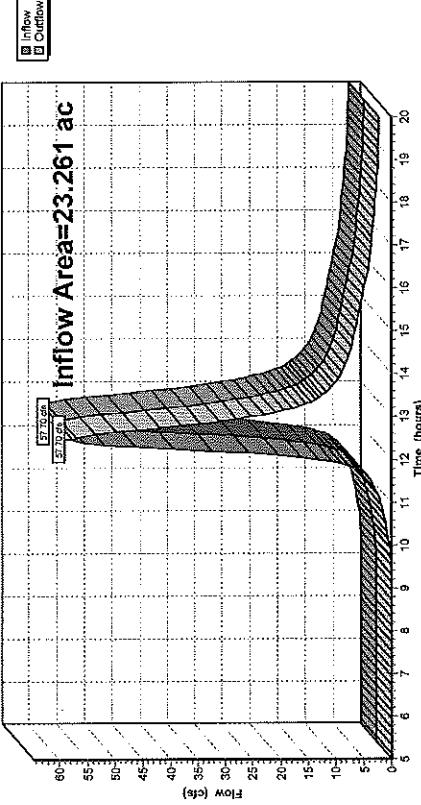
Summary for Reach IP-3: WETLANDS

Inflow Area = 23.261 ac, 3.38% Impervious, Inflow Depth > 3.64" for 100YR event
Inflow = 57.70 cfs @ 12.48 hrs, Volume= 7.051 af
Outflow = 57.70 cfs @ 12.48 hrs, Volume= 7.051 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-3: WETLANDS

Hydrograph



PRE DEVELOPMENT Type III 24-hr 100YR Rainfall=8.84" Printed 5/22/2017

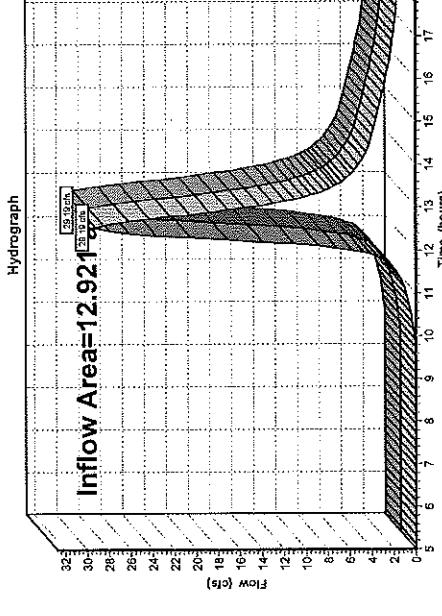
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Summary for Reach IP-4: PROP. LINE

Inflow Area = 12.921 ac, 2.13% Impervious, Inflow Depth > 3.52" for 100YR event
Inflow = 29.19 cfs @ 12.54 hrs, Volume= 3.785 af
Outflow = 29.19 cfs @ 12.54 hrs, Volume= 3.785 af, Atten= 0%, Lag= 0.0 min

Routing by StoR-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-4: PROP. LINE



PRE DEVELOPMENT Type III 24-hr 100YR Rainfall=8.84" Printed 5/22/2017

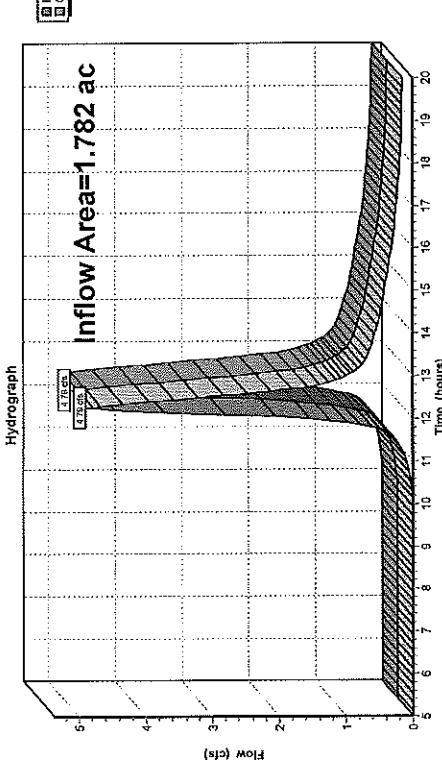
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Summary for Reach IP-5: property line

Inflow Area = 1.782 ac, 0.00% Impervious, Inflow Depth > 3.08" for 100YR event
Inflow = 4.79 cfs @ 12.26 hrs, Volume= 0.458 af
Outflow = 4.79 cfs @ 12.26 hrs, Volume= 0.458 af, Atten= 0%, Lag= 0.0 min

Routing by StoR-Ind+Trans method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Reach IP-5: property line



DRAINAGE ANALYSIS

HydroCAD Calculations – Proposed Conditions

post development 1-17

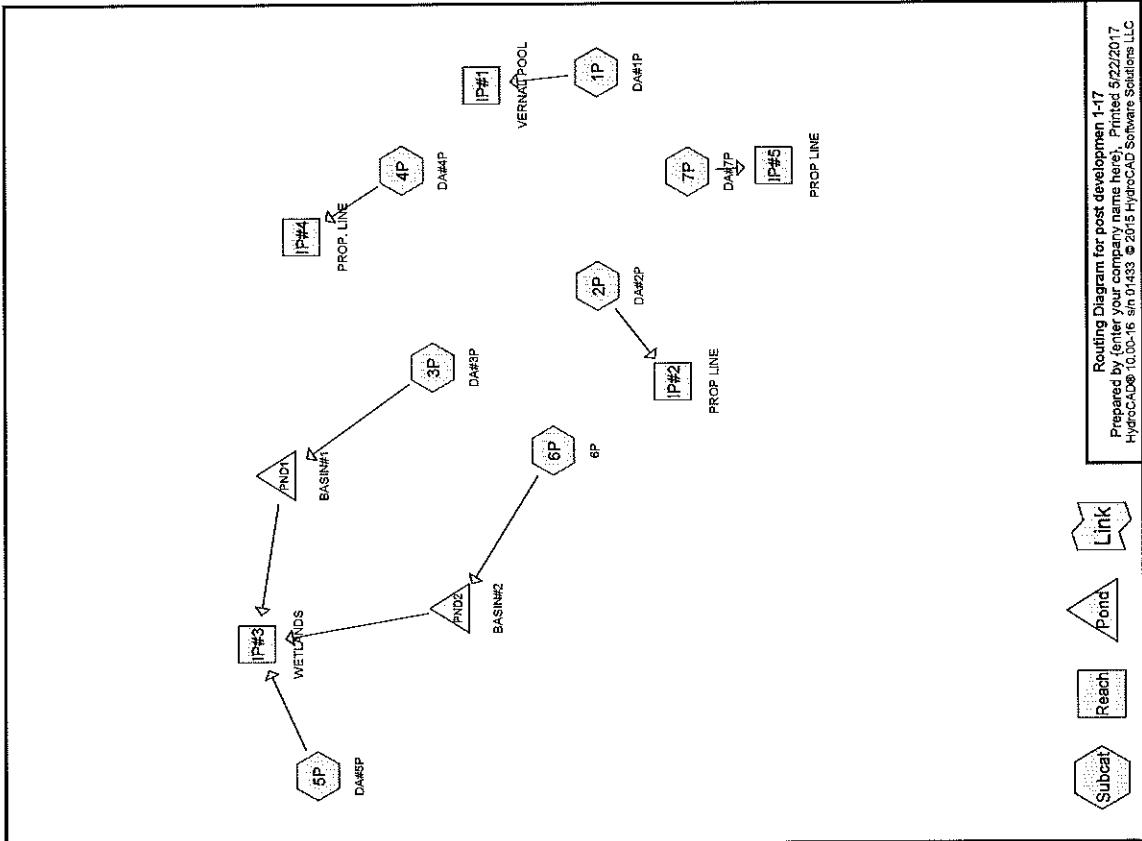
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5/22/2017 Page 2

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
18.328	61	>75% Grass cover, Good, HSG B (1P, 2P, 3P, 4P, 5P, 6P)
4.462	98	Paved parking & roofs (1P, 2P, 3P, 4P)
0.786	98	Paved parking, HSG A (5P)
1.125	98	Paved parking, HSG B (6P)
24.036	55	Woods, Good, HSG B (1P, 3P, 5P, 6P, 7P)
8.534	58	Wood/grass comb., Good, HSG B (2P, 4P)



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Page 3**Pipe Listing (all nodes)**

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	1P	0.00	0.00	100.0	0.0150	0.012	12.0	0.0	0.0
2	6P	0.00	0.00	283.0	0.0500	0.011	12.0	0.0	0.0

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Page 4**Summary for Subcatchment 1P: DA#1P**

Type III 24-hr 2 YR Rainfall=3.28"

Runoff by SCS TR-20 method. UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Type III 24-hr 2 YR Rainfall=3.28"

Area (sf)	CN	Description
24,004	98	Paved parking & roofs
80,175	61	>75% Grass cover, Good, HSG B
209,220	55	Woods, Good, HSG B
313,399	60	Weighted Average
289,335	60	92.34% PerVIOUS Area
24,004	7.66%	Impenious Area

Tc Length Slope Velocity Capacity Description

(min) (feet) (ft/ft) (ft/sec) (cfs)

Sheet Flow, TRAVEL PATH A TO B

Woods: Dense underbrush n= 0.800 P2= 3.20"

Shallow Concentrated Flow, TRAVEL PATH B TO C

Woodland Kv= 5.0 fps

Pipe Channel, TRAVEL PATH D TO E

12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'

r= 0.012 Concrete pipe, finished

Shallow Concentrated Flow, TRAVEL PATH E TO F

Grassed Waterway Kv= 15.0 fps

Shallow Concentrated Flow, TRAVEL PATH F TO G

Woodland Kv= 5.0 fps

38.3

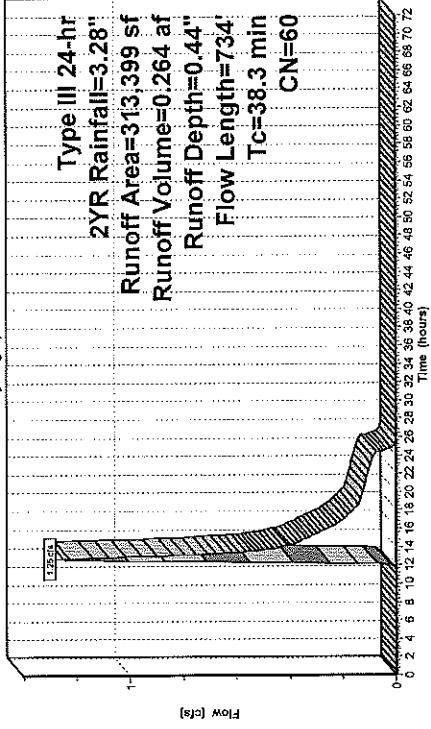
734 Total

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Type III 24-hr 2YR Rainfall=3.28"
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Subcatchment 1P: DA#2P

Hydrograph



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Type III 24-hr 2YR Rainfall=3.28"
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 Page 6

Summary for Subcatchment 2P: DA#2P

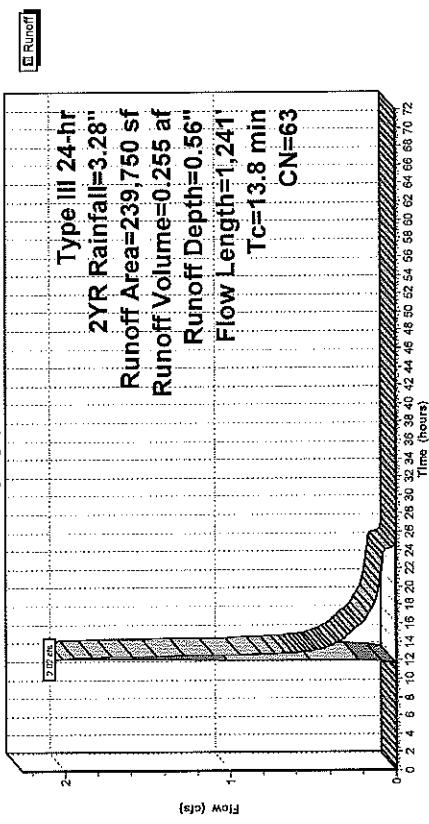
Runoff = 2.02 cfs @ 12.25 hrs, Volume= 0.255 af, Depth= 0.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 2YR Rainfall=3.28"

Area (sf)	CN	Description			
23,159	98	Paved parking & roofs			
127,862	61	>75% Grass cover, Good, HSG B			
88,749	58	Woods/grass comb., Good, HSG B			
239,750	63	Weighted Average			
216,551	90.32%	Pervious Area			
23,159	9.68%	Impervious Area			
Tc	Length	Slope	Velocity	Capacity	Description
(min)	(feet)	(feet)	(ft/sec)	(cfs)	
7.4	50	0.0100	0.11	Sheet Flow, TRAVEL PATH A TO B	
				Grass: Short n = 0.150 P2≈ 3.20"	
5.0	1,081	0.0500	3.60	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Unpaved KV= 16.1 fps	
1.4	110	0.0720	1.34	Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Woodland KV= 5.0 fps	
13.8	1,241	Total			

Subcatchment 2P: DA#2P

Hydrograph



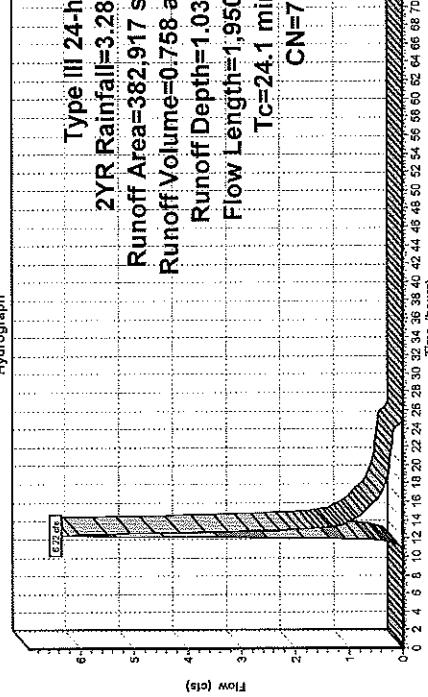
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Type III 24-hr 2YR Rainfall=3.28"
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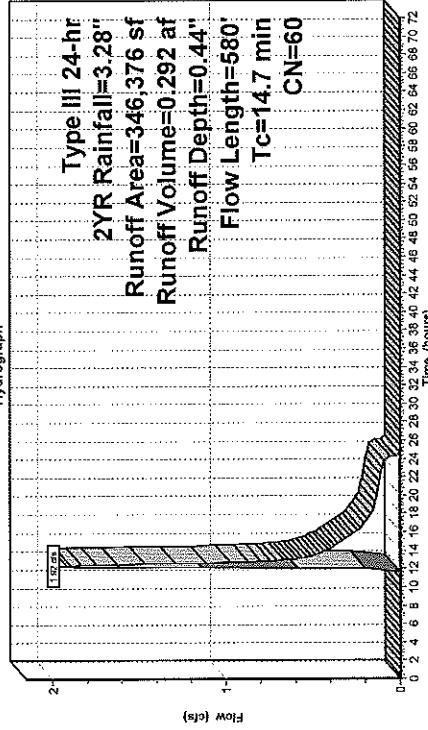
Summary for Subcatchment 3P: DA#3P

Runoff =	6.22 cfs @ 12.37 hrs, Volume=	0.758 af, Depth= 1.03"
Runoff by SCSTR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Type III 24-hr 2YR Rainfall=3.28"		
131,794	98	Paved parking & roofs
182,960	61	>75% Grass cover, Good, HSG B
68,163	55	Woods, Good, HSG B
382,917	73	Weighted Average
251,123	65.58%	Pervious Area
131,794	34.42%	Impervious Area
Tc	Length	Slope
(min)	(feet)	(ft/ft)
16.3	50	0.0400
0.8	200	0.0600
7.0	1,700	0.0400
24.1	1,950	
Velocity		
(ft/sec)		
0.05		
3.94		
4.06		
Total		
Capacity		
(cfs)		
Sheet Flow, TRAVEL PATH A TO B		
Woods: Dense underbrush n= 0.800 P2= 3.20"		
Shallow Concentrated Flow, TRAVEL PATH B TO C		
Unpaved Kv= 16.1 fps		
Shallow Concentrated Flow, TRAVEL PATH C TO D		
Paved Kv= 20.3 fps		

Subcatchment 3P: DA#3P



Subcatchment 4P: DA#4P



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Type III 24-hr 2YR Rainfall=3.28"
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 Page 8

Summary for Subcatchment 4P: DA#4P

Runoff =	1.92 cfs @ 12.31 hrs, Volume=	0.292 af, Depth= 0.44"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Type III 24-hr 2YR Rainfall=3.28"		
15,358	98	Paved parking & roofs
48,009	61	>75% Grass cover, Good, HSG B
283,009	53	Woods/grass comb., Good, HSG B
346,376	60	Weighted Average
331,018	95.57%	Pervious Area
15,358	4.43%	Impervious Area
Tc	Length	Slope
(min)	(feet)	(ft/ft)
5.1	50	0.0250
0.3	80	0.0750
9.3	450	0.0260
14.7	580	Total
Velocity		
(ft/sec)		
0.16		
4.41		
0.81		

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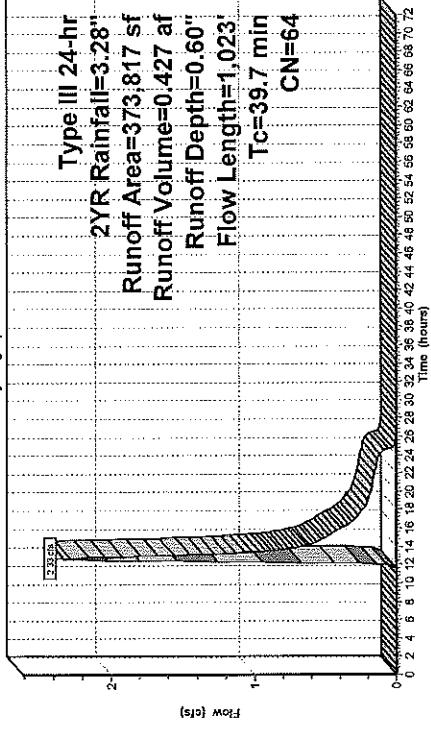
Type III 24-hr 2YR Rainfall=3.28"

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Page 11

Subcatchment 6P: 6P

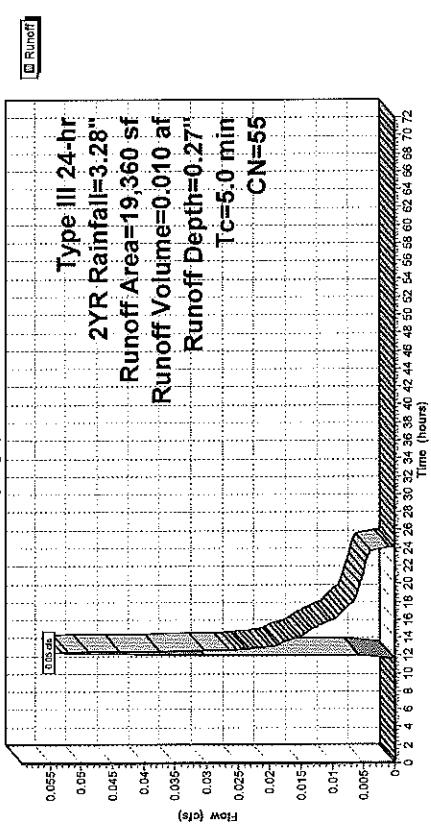
Hydrograph



**Type III 24-hr
2YR Rainfall=3.28"**
Runoff Area=373,817 sf
Runoff Volume=0.427 af
Runoff Depth=0.60"
Flow Length=1,023
Tc=39.7 min
CN=64

Subcatchment 7P: DA#7P

Hydrograph



Type III 24-hr 2YR Rainfall=3.28"
 Runoff by SCS TR-20 method. UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2YR Rainfall=3.28"
Runoff Area=19,360 sf
Runoff Volume=0.010 af
Runoff Depth=0.27"
Tc=5.0 min
CN=55

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Page 12

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Page 13

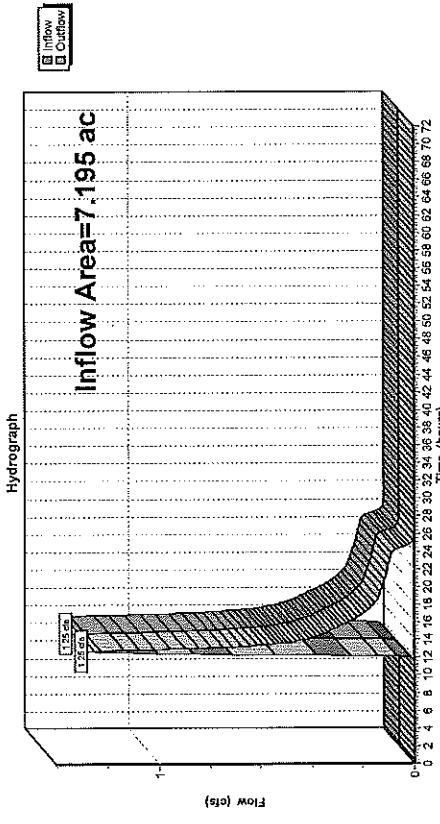
Type III 24-hr 2YR Rainfall=3.28"
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Page 14

Summary for Reach IP#1: VERNAL POOL

Inflow Area = 7.195 ac, 7.66% Impervious, Inflow Depth = 0.44" for 2YR event
Inflow = 1.25 cfs @ 12.69 hrs, Volume= 0.264 af
Outflow = 1.25 cfs @ 12.69 hrs, Volume= 0.264 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0:00-72.00 hrs, dt= 0.05 hrs

Reach IP#1: VERNAL POOL

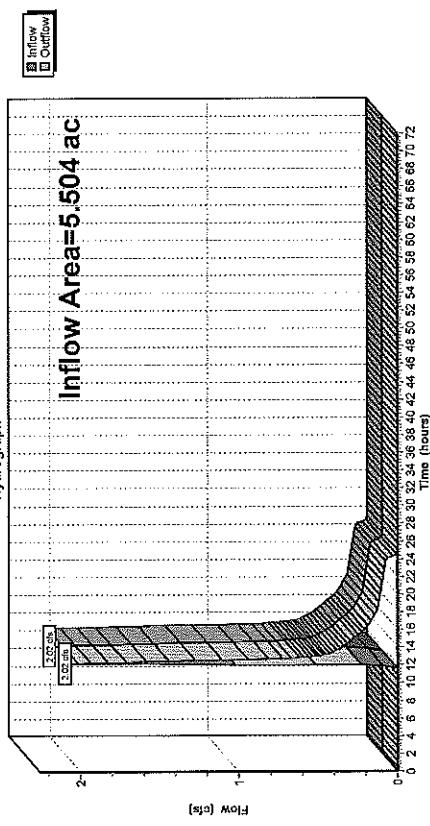


Summary for Reach IP#2: PROP LINE

Inflow Area = 5.504 ac, 9.68% Impervious, Inflow Depth = 0.55" for 2YR event
Inflow = 2.02 cfs @ 12.25 hrs, Volume= 0.235 af
Outflow = 2.02 cfs @ 12.25 hrs, Volume= 0.235 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0:00-72.00 hrs, dt= 0.05 hrs

Reach IP#2: PROP LINE



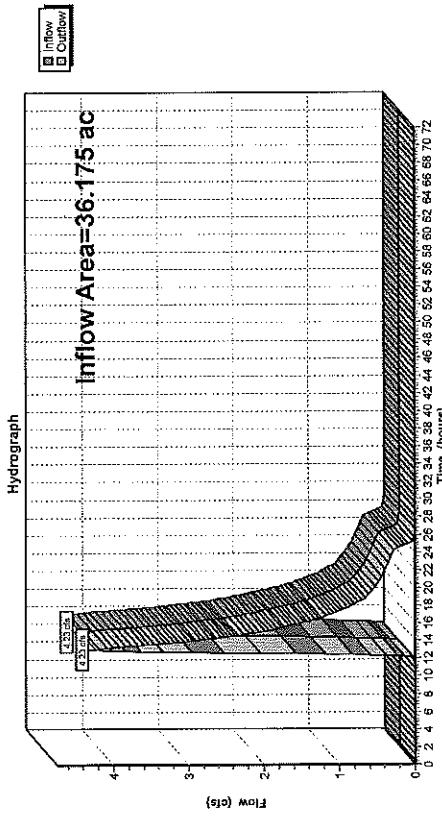
post development 1-17 Type /I/ 24-hr 2YR Rainfall=3.28"
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Summary for Reach IP#3: WETLANDS

Inflow Area = 36.175 ac, 13.65% Impervious, Inflow Depth = 0.41" for 2YR event
Inflow = 4.23 cfs @ 13.06 hrs, Volume= 1.243 af
Outflow = 4.23 cfs @ 13.06 hrs, Volume= 1.243 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#3: WETLANDS



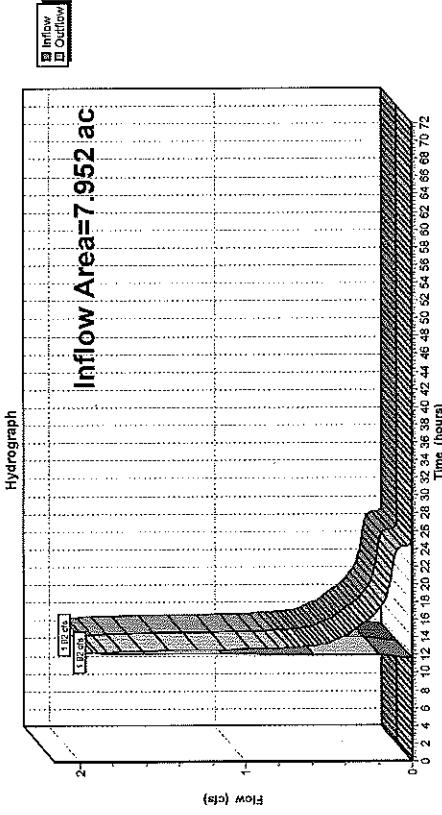
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Summary for Reach IP#4: PROP. LINE

Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 0.44" for 2YR event
Inflow = 1.92 cfs @ 12.31 hrs, Volume= 0.292 af
Outflow = 1.92 cfs @ 12.31 hrs, Volume= 0.292 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE



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 Page 17

Type III 24-hr 2YR Rainfall=3.28"

Summary for Reach IP#5: PROP LINE

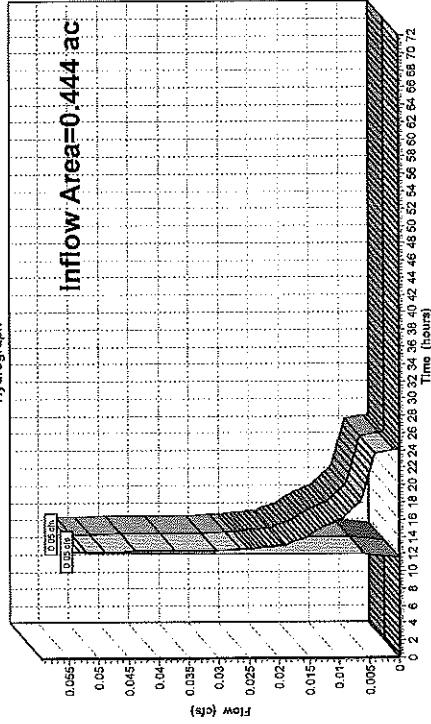
Inflow Area = 0.444 ac, 0.00% Impervious, Inflow Depth = 0.27" for 2YR event
 Inflow = 0.05 cfs @ 12.30 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min
 Outflow = 0.05 cfs @ 12.30 hrs, Volume= 0.010 af, Atten= 0%, Lag= 0.0 min
 Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#5: PROP LINE



Inflow Area=0.444 ac

Hydrograph



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 Page 18

Type III 24-hr 2YR Rainfall=3.28"

Summary for Pond PND1: BASIN#1

Inflow Area = 8.791 ac, 34.42% Impervious, Inflow Depth = 1.03" for 2YR event
 Inflow = 6.22 cfs @ 12.37 hrs, Volume= 0.758 af
 Outflow = 1.32 cfs @ 13.29 hrs, Volume= 0.758 af, Atten= 79%, Lag= 55.6 min
 Discardd = 0.22 cfs @ 13.29 hrs, Volume= 0.413 af
 Primary = 1.10 cfs @ 13.29 hrs, Volume= 0.345 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 375.66 @ 13.29 hrs Surf.Area= 9,245 sf Storage= 13,641 cf

Plug-Flow detention time= 0.758 min calculated for 0.758 af (100% of inflow)
 Center-of-Mass det. time= 328.5 min (1.208 hr - 880.6)

Volume	Invert	Avail Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recalc)
#1	374.00'	82,639 cf		
Elevation	Surf.Area (sq-ft)	Incl.Store (cubic-feet)	Cum.Store (cubic-feet)	
(feet)				
374.00	7,184	0	0	
376.00	9,665	16,850	16,850	
378.00	12,357	22,023	38,873	
380.00	15,306	27,683	66,536	
381.00	16,900	16,103	82,639	
Device	Routing	Invert	Outlet Devices	
#1	Discarded	374.00'	1.020 in/hr Exfiltration over Surface area	
#2	Primary	375.00'	6.0" Vert. Orifice/Grate C= 0.600	
#3	Primary	375.25'	8.0" Vert. Orifice/Grate C= 0.600	
#4	Primary	378.25'	12.0" Vert. Orifice/Grate C= 0.600	

Discarded OutFlow Max=0.22 cfs @ 13.29 hrs HW=375.66' (Free Discharge)

Primary OutFlow Max=1.10 cfs @ 13.29 hrs HW=375.66' (Free Discharge)

2=Orifice/Grate (Orifice Controls 0.61 cfs @ 3.09 ips)

3=Orifice/Grate (Orifice Controls 0.49 cfs @ 2.18 ips)

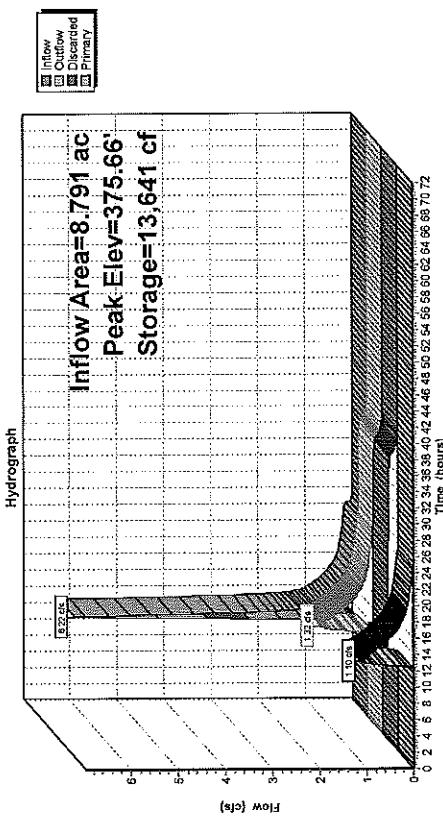
4=Orifice/Grate (Controls 0.00 cfs)

1=Exfiltration (Exfiltration Controls 0.22 cfs)

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 Page 19

Pond PND1: BASIN#1



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 Page 20

Summary for Pond PND2: BASIN#2

Inflow Area = 8.582 ac, 13.11% Impervious, Inflow Depth = 0.60" for 2YR event
 Inflow = 2.33 cfs @ 12.66 hrs, Volume= 0.427 af
 Outflow = 1.29 cfs @ 13.19 hrs, Volume= 0.427 af, Atten= 45%, Lag= 31.5 min
 Discard = 0.11 cfs @ 13.19 hrs, Volume= 0.109 af
 Primary = 1.18 cfs @ 13.19 hrs, Volume= 0.318 af
 Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 370.81' @ 13.19 hrs Surf.Area= 4,825 sf Storage= 3,479 cf

Plug-Flow detention time= 48.3 min calculated for 0.427 af (100% of inflow)
 Center-of-Mass det. time= 48.0 min (976.6 - 928.5)

Volume	Invert	Avail.Storage	Storage Description
#1	370.00'	35,650 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
370.00	3,750	0	0
372.00	6,400	10,150	10,150
374.00	9,300	15,700	25,850
375.00	10,300	9,800	35,650

Device Routing Invert Outlet Devices
 #1 Discarded 370.00' 1.020 in/hr Exfiltration over Surface area
 #2 Primary 370.00' 8.0" Vert. Orifice/Grate C= 0.600
 #3 Primary 370.75' 10.0" Vert. Orifice/Grate C= 0.600
 #4 Primary 372.85' 12.0" Vert. Orifice/Grate C= 0.600

Discarded OutFlow Max=0.11 cfs @ 13.19 hrs HW=370.81' (Free Discharge)

↓
 1=Exfiltration (Exfiltration Controls 0.11 cfs)

Primary OutFlow Max=1.18 cfs @ 13.19 hrs HW=370.81' (Free Discharge)

↓
 2=Office/Grate (Orifice Controls 1.16 cfs @ 3.33 rps)

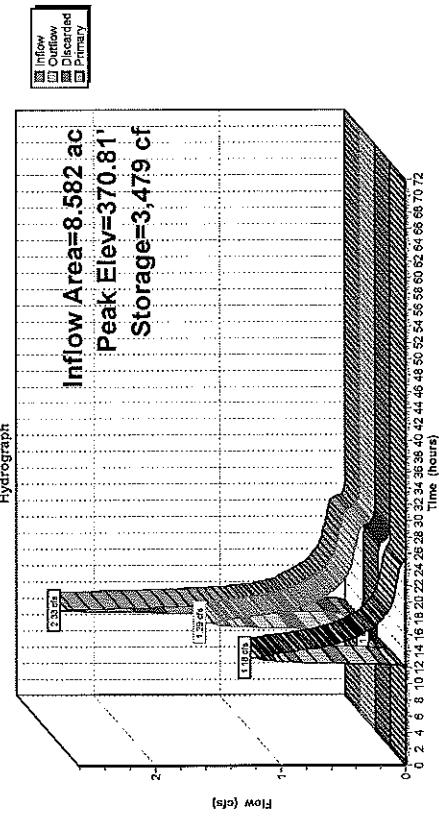
↓
 3=Office/Grate (Orifice Controls 0.02 cfs @ 0.84 rps)

↓
 4=Office/Grate (Controls 0.00 cfs)

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 Page 21

Pond PND2: BASIN#2



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 Page 22

Summary for Subcatchment 1P: DA#1P

Runoff =	4.67 cfs @ 12.60 hrs. Volume=	0.742 af, Depth= 1.24"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs		
Type III 24-hr 10YR REV Rainfall=4.89"		
Area (sf)	CN	Description
24,004	98	Paved parking & roofs
80,175	61	>75% Grass cover, Good, HSG B
209,220	55	Woods, Good, HSG B
313,399	60	Weighted Average
289,395	60	92.34% PerVIOUS Area
24,004		7.66% Impervious Area
Tc	Length	Slope
(min)	(feet)	(feet)
28.3	50	0.0100
		0.03
		Velocity (ft/sec)
		Capacity (cfs)
		Description
Sheet Flow, TRAVEL PATH A TO B		
Woods; Dense underbrush n= 0.800 P2= 3.20"		
Shallow Concentrated Flow, TRAVEL PATH B TO C		
Woodland Kv= 5.0 fps		
Pipe Channel, TRAVEL PATH D TO E		
12.0' Round Area= 0.8 sf Perim= 3.1' r= 0.25'		
n= 0.012 Concrete pipe, finished		
Shallow Concentrated Flow, TRAVEL PATH E TO F		
Grassed Waterway Kv= 15.0 fps		
Shallow Concentrated Flow, TRAVEL PATH F TO G		
Woods, Kv= 5.0 fps		
38.3	734	Total

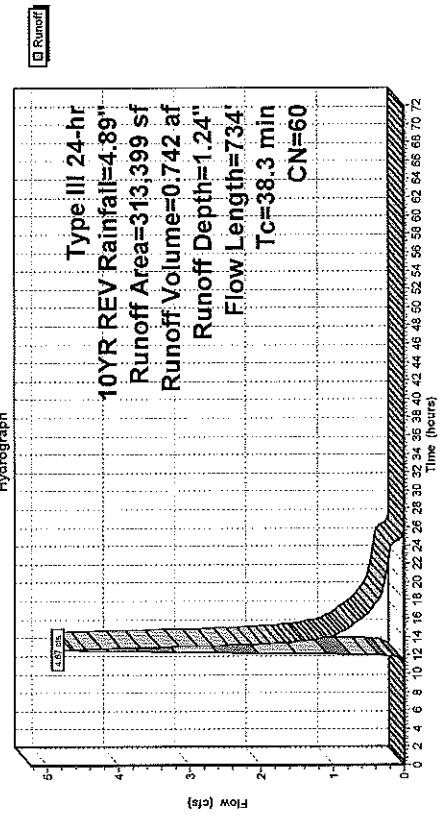
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Type III 24-hr 10YR REV Rainfall=4.89"

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Page 23

Subcatchment 1P: DA#1P



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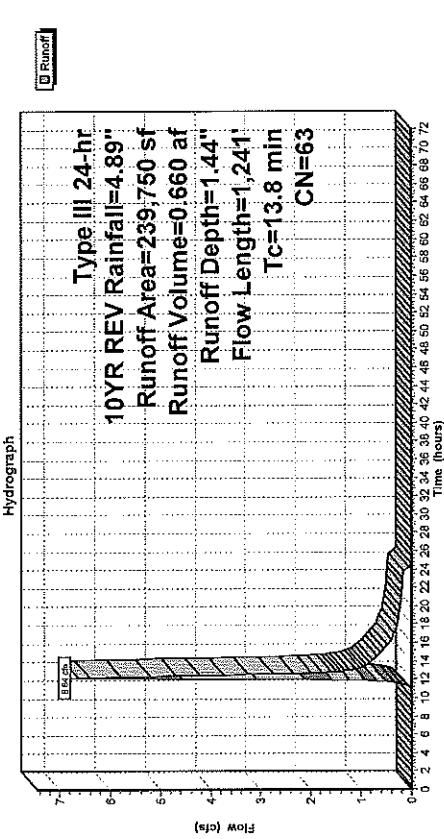
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Page 24

Summary for Subcatchment 2P: DA#2P

Runoff	=	6.64 cfs @ 12.21 hrs, Volume= 0.660 af, Depth= 1.44"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs Type III 24-hr 10YR REV Rainfall=4.89"		
Area (sf)	CN	Description
23,199	98	Paved Parking & roofs
127,802	61	>75% Grass cover, Good, HSG B
88,749	58	Wood/grass comb., Good, HSG B
239,750	63	Weighted Average
216,551		90.32% Pervious Area
23,199		9.68% Impervious Area
Tc	Length	Slope
(min)	(feet)	(ft/sec)
7.4	50	0.0100
		0.11
		Sheet Flow, TRAVEL PATH A TO B
		Grass: Short n = 0.150 P2= 3.20"
		Upflow Concentrated Flow, TRAVEL PATH B TO C
		Kv= 16.1 fps
		Shallow Concentrated Flow, TRAVEL PATH C TO D
		Woodland Kv= 5.0 fps
13.8	1.241	Total

Subcatchment 2P: DA#2P



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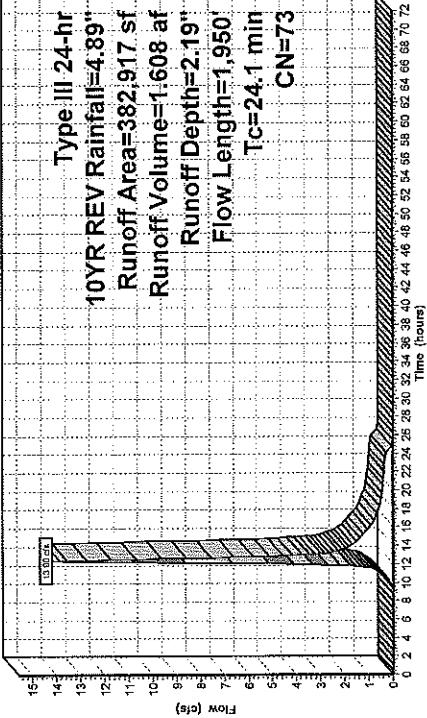
Type III 24-hr 10YR REV Rainfall=4.89"
 Printed 5/22/2017
 Page 25

Summary for Subcatchment 3P: DA#3P

Runoff	=	13.90 cfs @ 12.35 hrs, Volume=	1.608 af, Depth= 2.19"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs			
Type III 24-hr 10YR REV Rainfall=4.89"			
Tc	Length	Slope	Capacity
(min)	(feet)	(ft/ft)	(cfs)
16.3	50	0.0400	0.05
			Sheet Flow, TRAVEL PATH A TO B
			Woods, Dense underbrush n= 0.800 P2= 3.20"
0.8	200	0.0600	3.94
			Shallow Concentrated Flow, TRAVEL PATH B TO C
			Unpaved Kv= 16.1 fps
7.0	1,700	0.0400	4.06
			Shallow Concentrated Flow, TRAVEL PATH C TO D
			Paved Kv= 20.3 fps
24.1	1,950	Total	

Subcatchment 3P: DA#3P

Hydrograph



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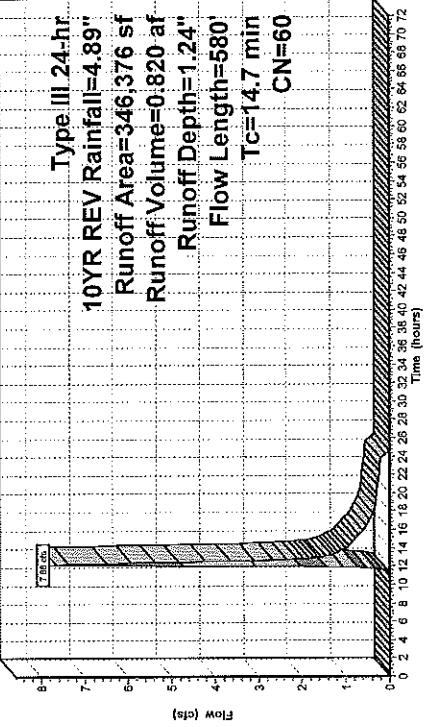
Type III 24-hr
 Printed 5/22/2017
 Page 26

Summary for Subcatchment 4P: DA#4P

Runoff	=	7.66 cfs @ 12.23 hrs, Volume=	0.820 af, Depth= 1.24"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs			
Type III 24-hr 10YR REV Rainfall=4.89"			
Area (sf)	CN	Description	
131,794	98	Paved parking & roofs	
182,960	61	>75% Grass cover, Good, HSG B	
88,163	55	Woods, Good, HSG B	
382,917	73	Weighted Average	
251,123		65.58% Permeous Area	
131,794		34.42% Impervious Area	
Tc	Length	Slope	Capacity
(min)	(feet)	(ft/ft)	(cfs)
5.1	50	0.0250	0.16
			Sheet Flow, TRAVEL PATH A TO B
			Grass, Short n= 0.150 P2= 3.20"
0.3	80	0.0750	4.41
			Shallow Concentrated Flow, TRAVEL PATH B TO C
			Unpaved Kv= 16.1 fps
9.3	450	0.0250	0.81
			Shallow Concentrated Flow, TRAVEL PATH C TO D
			Woodland Kv= 5.0 fps
14.7	580	Total	

Subcatchment 4P: DA#4P

Hydrograph



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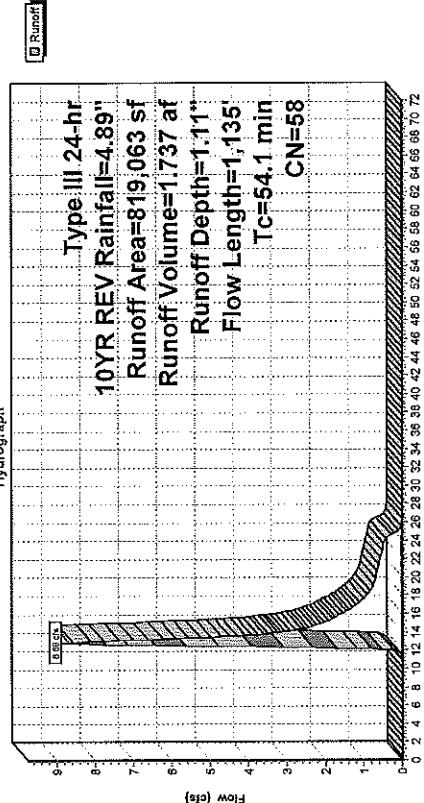
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 Page 27

Summary for Subcatchment 5P: DA#5P

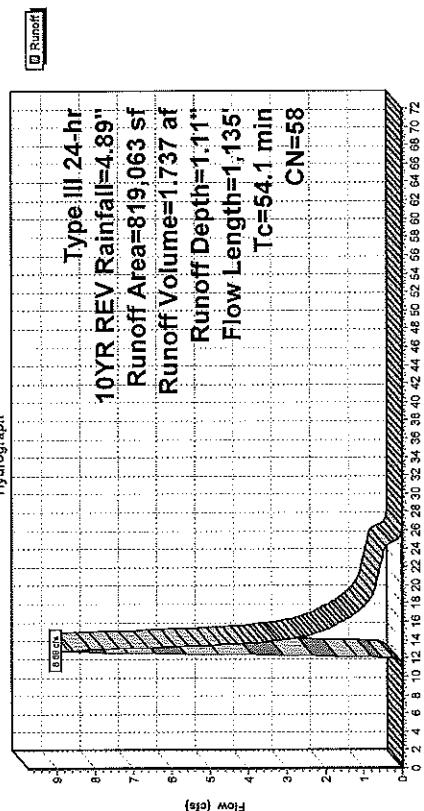
Runoff = 8.69 cfs @ 12.84 hrs, Volume= 1,737 sf, Depth= 1.11"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR REV Rainfall=4.89"

Tc	Length (min)	Slope (feet/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B	
31.2	935	0.0100	0.50	Woods: Dense underbrush n=0.800 P2= 3.20' Shallow Concentrated Flow, TRAVEL PATH B TO C	
1.4	150	0.0300	1.73	Woodland Kv= 5.0 fps Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Utilized Kv= 10.0 fps	
54.1	1,135	Total			

Hydrograph


Subcatchment 5P: DA#5P



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 Page 28

Summary for Subcatchment 6P: 6P

Runoff = 7.02 cfs @ 12.60 hrs, Volume= 1,060 sf, Depth= 1.51"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 10YR REV Rainfall=4.89"

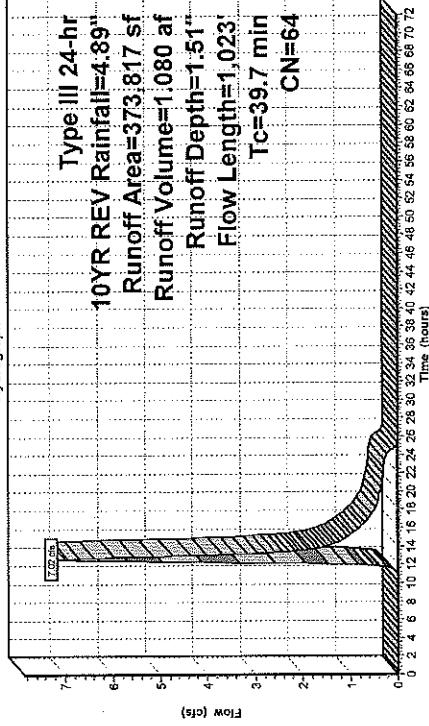
Area (sf)	CN	Description
49,012	98	Paved parking, HSG B
206,262	61	>75% Grass cover, Good, HSG B
118,543	55	Woods, Good, HSG B
373,817	64	Weighted Average 86.89% Perious Area
324,805		
49,012		13.11% Impervious Area
39.7	1,023	Total

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Page 29

Subcatchment 6P: 6P

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Page 30

Summary for Subcatchment 7P: DA#7P

Runoff = 0.39 cfs @ 12.10 hrs, Volume= 0.034 af, Depth= 0.93"

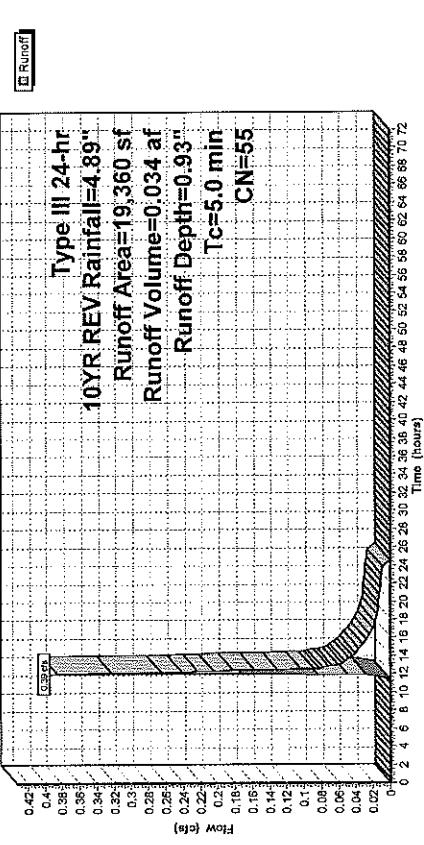
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10YR REV Rainfall=4.89"

Area (sf)	CN	Description
19,360	55	Woods, Good, HSG B
19,360	100.00%	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					Direct Entry, TRAVEL TIME

Subcatchment 7P: DA#7P

Hydrograph



Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=373,817 sf

Runoff Volume=1,080 af

Runoff Depth=1.51"

Flow Length=1,023

Tc=39.7 min

CN=64

Runoff

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

10YR REV Rainfall=4.89"

Runoff Area=19,360 sf

Runoff Volume=0.034 af

Runoff Depth=0.93"

Tc=5.0 min

CN=55

Type III 24-hr

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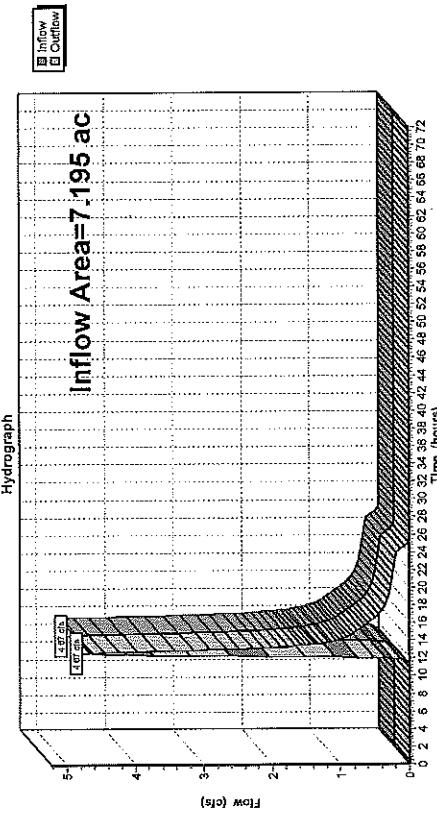
Type III 24-hr 10YR REV Rainfall=4.89"
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Page 31

Summary for Reach IP#1: VERNAL POOL

Inflow Area = 7.195 ac, 7.66% Impervious, Inflow Depth = 1.24" for 10YR REV event
Inflow = 4.67 cfs @ 12.60 hrs, Volume= 0.742 af
Outflow = 4.67 cfs @ 12.60 hrs, Volume= 0.742 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#1: VERNAL POOL



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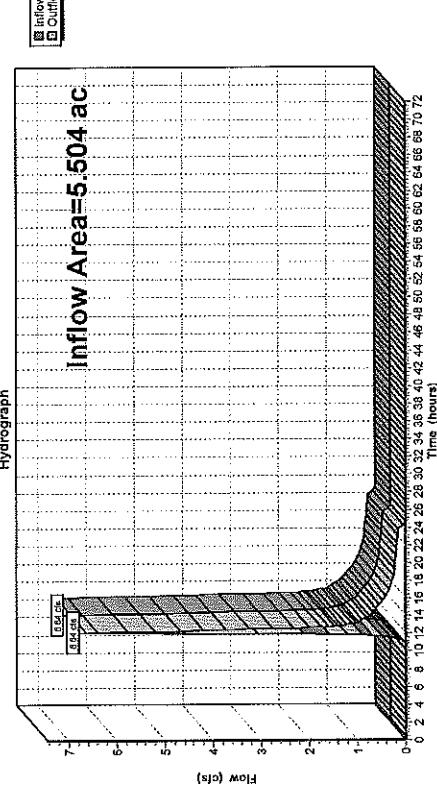
Type III 24-hr 10YR REV Rainfall=4.89"
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Page 32

Summary for Reach IP#2: PROPLINE

Inflow Area = 5.504 ac, 9.68% Impervious, Inflow Depth = 1.44" for 10YR REV event
Inflow = 6.64 cfs @ 12.21 hrs, Volume= 0.660 af
Outflow = 6.64 cfs @ 12.21 hrs, Volume= 0.660 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#2: PROPLINE



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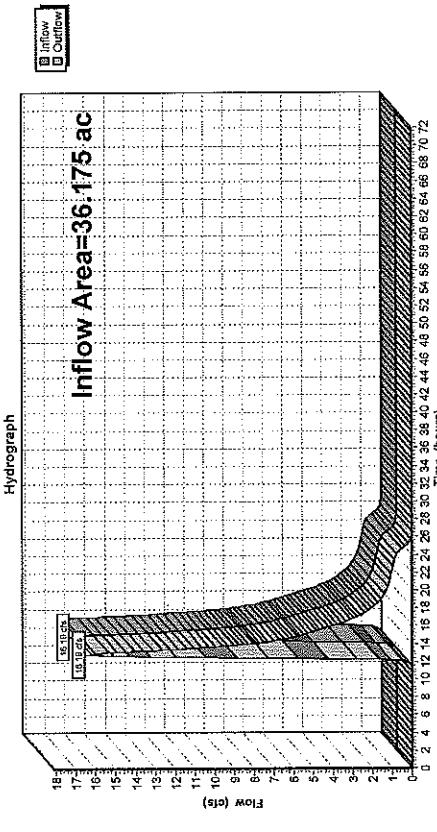
Type III 24-hr 10YR REV Rainfall=4.89"
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Page 33

Summary for Reach IP#3: WETLANDS

Inflow Area = 36.175 ac, 13.65% Impervious, Inflow Depth = 1.27" for 10YR REV event
Inflow = 16.19 cfs @ 12.88 hrs, Volume= 3.832 af
Outflow = 16.19 cfs @ 12.88 hrs, Volume= 3.832 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#3: WETLANDS



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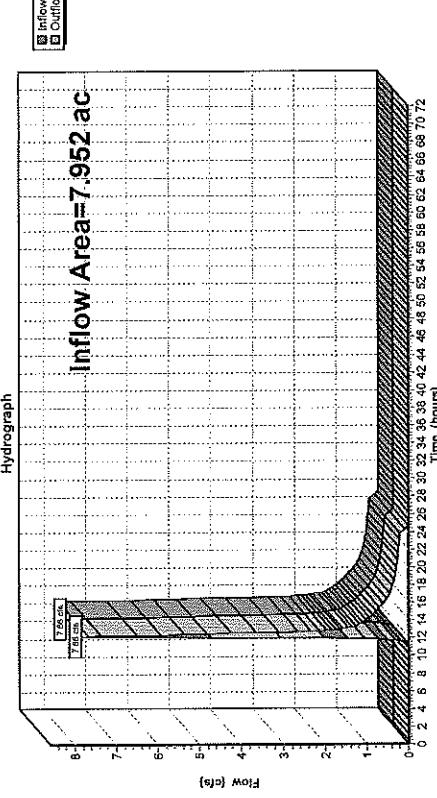
Type III 24-hr 10YR REV Rainfall=4.89"
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Page 34

Summary for Reach IP#4: PROP. LINE

Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 1.24" for 10YR REV event
Inflow = 7.66 cfs @ 12.23 hrs, Volume= 0.820 af
Outflow = 7.66 cfs @ 12.23 hrs, Volume= 0.820 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE



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Page 35

Summary for Reach IP#5: PROP LINE

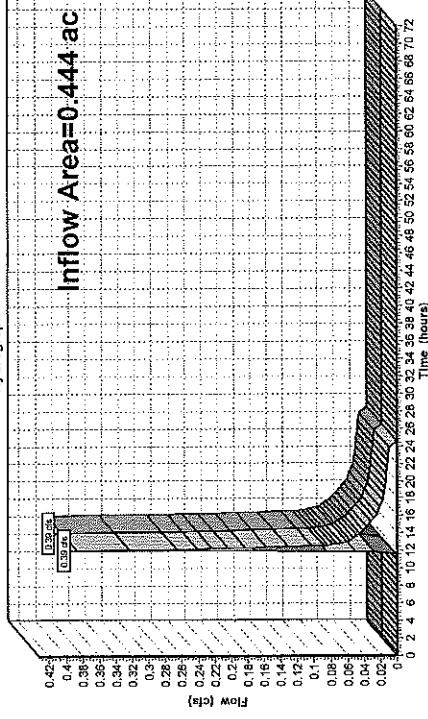
Inflow Area = 0.444 ac, 0.00% Impervious, Inflow Depth = 0.93" for 10YR REV event
 Inflow = 0.39 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 0.0 min
 Outflow = 0.39 cfs @ 12.10 hrs, Volume= 0.034 af, Atten= 0%, Lag= 41.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#5: PROP LINE



Inflow Area=0.444 ac



Discarded OutFlow Max=0.26 cfs @ 13.03 hrs HW=377.08' (Free Discharge)

↓=1=Exfiltration (Exfiltration Controls 0.26 cfs)

Primary OutFlow Max=3.33 cfs @ 13.03 hrs HW=377.08' (Free Discharge)

↓=2=Office/Grate (Orifice Controls 1.28 cfs @ 6.51 fps)

↓=3=Office/Grate (Orifice Controls 2.06 cfs @ 5.89 fps)

↓=4=Office/Grate (Controls 0.00 cfs)

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Summary for Pond PND1: BASIN#1

Inflow Area = 8.791 ac, 34.42% Impervious, Inflow Depth = 2.19" for 10YR REV event
 Inflow = 13.90 cfs @ 12.35 hrs, Volume= 1.608 af, Atten= 74%, Lag= 41.0 min
 Outflow = 3.60 cfs @ 13.03 hrs, Volume= 1.608 af, Atten= 74%, Lag= 41.0 min
 Discharged = 0.26 cfs @ 13.03 hrs, Volume= 0.465 af
 Primary = 3.33 cfs @ 13.03 hrs, Volume= 1.142 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 377.08' @ 13.03 hrs Surf.Area= 11.118 sf Storage= 28,066 cf

Plug-Flow detention time= 209.5 min calculated for 1.606 af (100% of inflow)
 Center-of-Mass det. time= 210.0 min (1,067.9 - 857.9)

Volume	Invert	Avail. Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recalc)
#1 374.00'	82,639 cf			

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
374.00	7,184	0	0
375.00	9,656	16,850	16,850
376.00	12,357	22,023	38,873
378.00	15,306	27,663	66,536
380.00	16,900	16,103	82,639

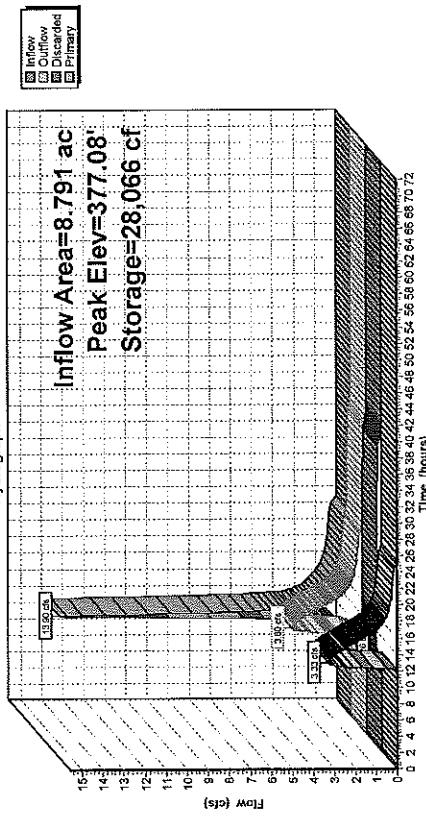
Device	Routing	Invert	Outlet Devices
#1	Discarded	374.00'	1.020 in/hr Exfiltration over Surface area
#2	Primary	375.00'	6.0" Vert. Orifice/Grate C= 0.600
#3	Primary	375.25'	8.0" Vert. Orifice/Grate C= 0.600
#4	Primary	378.25'	12.0" Vert. Orifice/Grate C= 0.600

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Page 37

Pond PND1: BASIN#1

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Page 38

Summary for Pond PND2: BASIN#2

Inflow Area = 8.582 ac, 13.11% Impervious, Inflow Depth = 1.51" for 10YR REV event
Inflow = 7.02 cfs @ 12.80 hrs, Volume= 1.080 af
Outflow = 4.44 cfs @ 12.98 hrs, Volume= 1.080 af, Attenu= 37%, Lag= 23.4 min
Discard = 0.15 cfs @ 12.98 hrs, Volume= 0.128 af
Primary = 4.29 cfs @ 12.99 hrs, Volume= 0.952 af

Routing by Stor-Ind method, Time Spans= 0.00-72.00 hrs, dt= 0.05 hrs

Peak Elev= 371.87 @ 12.99 hrs Surf.Area= 6,233 sf Storage= 9,355 cf

Plug-Flow detention time= 41.4 min calculated for 1.079 af (100% of inflow)
Center-of-Mass det. time= 41.5 min (937.8 - 896.3)

Volume	Invert	Avail Storage	Storage Description	Custom Stage Data [Prismatic] Listed below (Recalc)
#1	370.00'	35,650 cf		
Elevation	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
(feet)				
370.00	3,750	0	0	
372.00	6,400	10,150	10,150	
374.00	9,300	15,700	25,850	
375.00	10,300	9,800	35,650	

Device Routing Invert Outlet Devices
#1 Discarded 370.00' 1.020 in/hr Exfiltration over Surface area
#2 Primary 370.00' 8.0" Vert. Orifice/Grate C= 0.600
#3 Primary 370.75' 10.0" Vert. Orifice/Grate C= 0.600
#4 Primary 372.85' 12.0" Vert. Orifice/Grate C= 0.600

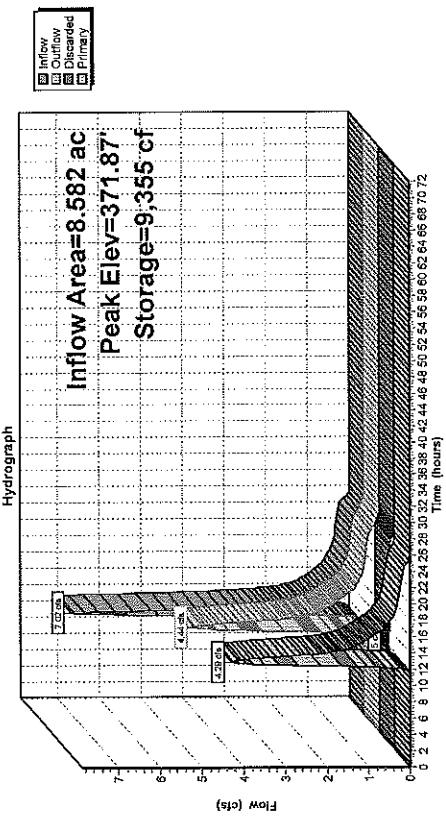
Discarded OutFlow Max=0.15 cfs @ 12.99 hrs HW=371.87' (Free Discharge)
↓=1=Exfiltration (Exfiltration Controls 0.15 cfs)

Primary OutFlow Max=4.29 cfs @ 12.99 hrs HW=371.87' (Free Discharge)
↓=2=Office/Grate (Office Controls 2.09 cfs @ 5.38 tps)
↓=3=Office/Grate (Office Controls 2.21 cfs @ 4.05 tps)
↓=4=Office/Grate (Controls 0.00 cfs)

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 Page 39

Pond PND2: BASIN#2



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 Page 40

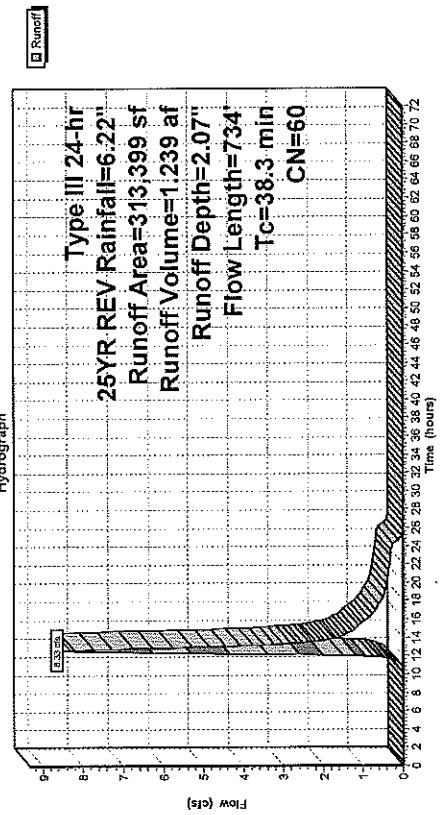
Summary for Subcatchment 1P: DA#1P

Runoff	=	8.33 cfs @ 12.57 hrs, Volume=	1.239 af, Depth=	2.07"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs				
Type III 24-hr 25YR REV Rainfall=6.22"				
Area (sf)	CN	Description		
24,004	98	Paved Parking & roofs		
80,175	61	>75% Grass cover, Good, HSG B		
209,220	55	Woods, Good, HSG B		
313,399	60	Weighted Average		
289,395	60	92.34% Pervious Area		
24,004		7.66% Impervious Area		
Tc	Length	Slope	Velocity	Capacity
(min)	(feet)	(feet)	(ft/sec)	(cfs)
28.3	50	0.0100	0.03	Street Flow, TRAVEL PATH A TO B
				Woods: Dense Underbrush n= 0.800 P2= 3.20"
				Shallow Concentrated Flow, TRAVEL PATH B TO C
				Woodland Kv= 5.0 fps
				Pipe Channel, TRAVEL PATH D TO E
				12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
				n= 0.012 Concrete pipe, finished
				Shallow Concentrated Flow, TRAVEL PATH E TO F
				Grassed Waterway Kv= 15.0 fps
				Shallow Concentrated Flow, TRAVEL PATH F TO G
				Woodland Kv= 5.0 fps
38.3	734	Total		

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 Page 41

Subcatchment 1P: DA#1P



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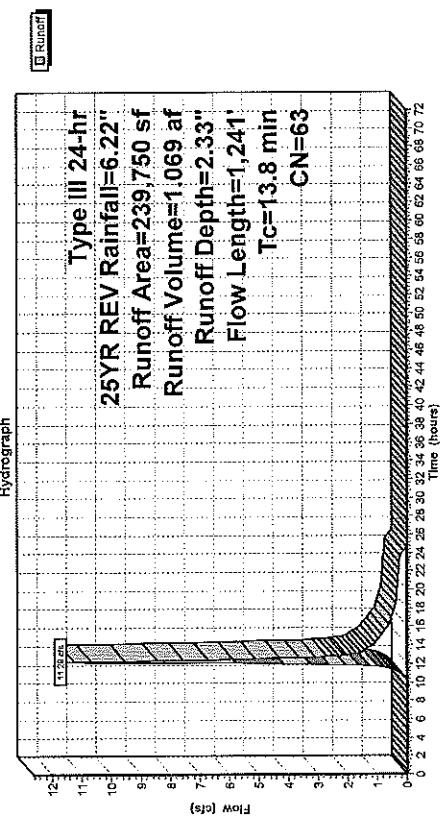
Type III 24-hr 25YR REV Rainfall=6.22"
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 Page 42

Summary for Subcatchment 2P: DA#2P

Runoff = 11.29 cfs @ 12.20 hrs, Volume= 1.069 af, Depth= 2.33"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR REV Rainfall=6.22"

Area (sf)	CN	Description			
23,199	98	Paved parking & roofs			
127,812	61	>75% Grass cover, Good, HSG B			
88,749	58	Woods/grass comb., Good, HSG B			
239,750	63	Weighted Average			
216,551		90.32% Pervious Area			
23,199		9.68% Impervious Area			
Tc (min)	Length (feet)	Slope (ft/feet)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11	Sheet Flow, TRAVEL PATH A TO B	
				Grass: Short n= 0.150 P2= 3.20"	
5.0	1,081	0.0500	3.60	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Up paved KV= 16.1 fpm	
1.4	110	0.0720	1.34	Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Woodland KV= 5.0 fpm	
13.8	1,241	Total			

Subcatchment 2P: DA#2P



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 Page 43

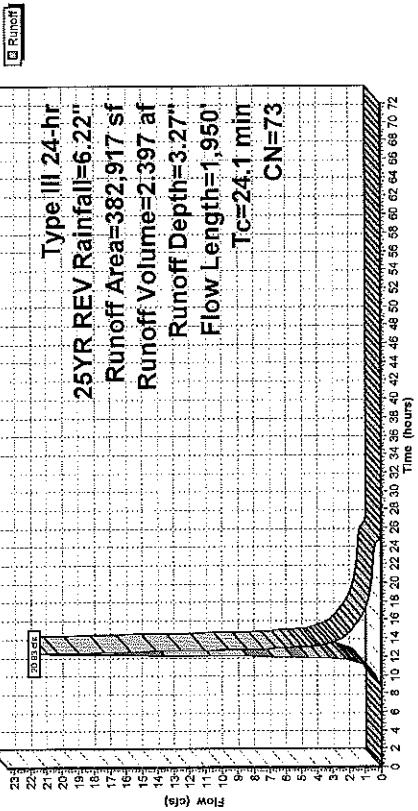
Summary for Subcatchment 3P: DA#3P

Runoff = 20.93 cfs @ 12.34 hrs, Volume= 2.397 af, Depth= 3.27"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR REV Rainfall=6.22"

Tc	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05	Sheet Flow, TRAVEL PATH A TO B	
				Woods: Dense underbrush n= 0.800 P= 3.20"	
0.8	200	0.0600	3.94	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Unpaved Kv= 16.1 fps	
7.0	1,700	0.0400	4.06	Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Paved Kv= 20.3 fps	
24.1	1,950	Total			

Subcatchment 3P: DA#3P

Hydrograph



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 Page 44

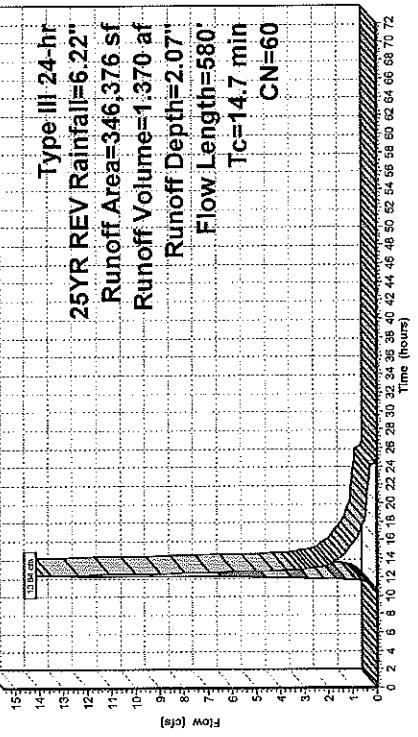
Summary for Subcatchment 4P: DA#4P

Runoff = 13.84 cfs @ 12.22 hrs, Volume= 1.370 af, Depth= 2.07"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR REV Rainfall=6.22"

Area (sf)	CN	Description	Area (sf)	CN	Description
131,794	98	Paved parking & roofs	15,358	98	Paved parking & roofs
182,960	61	>75% Grass cover, Good, HSG B	48,009	61	>75% Grass cover, Good, HSG B
68,163	55	Woods: Good, HSG B	283,009	58	Woods/grass comb., Good, HSG B
382,917	73	Weighted Average	346,376	60	Weighted Average
251,123		65.58% PerVIOUS Area	331,018		95.57% PerVIOUS Area
131,794		34.42% Impervious Area	15,358		4.43% Impervious Area
24.1	1,950	Total	14.7	580	Total

Subcatchment 4P: DA#4P

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 Page 45

Summary for Subcatchment 5P: DA#5P

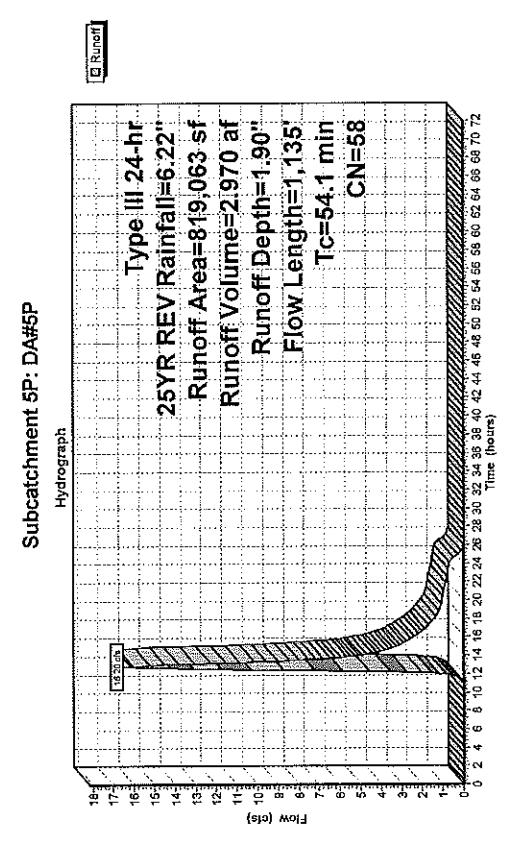
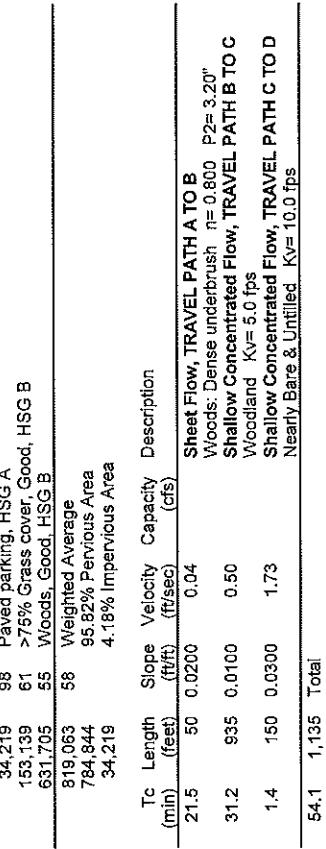
Runoff = 16.20 cfs @ 12.80 hrs, Volume=

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 25YR REV Rainfall=6.22"

Tc	Length (min)	Slope (feet)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Sheet Flow, TRAVEL PATH A TO B	
31.2	93.5	0.0100	0.50	Woods: Dense underbrush n=0.800 P2=3.20"	
1.4	150	0.0300	1.73	Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kt= 5.0 fps	
54.1	1,135	Total		Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Untilled Kt= 10.0 fps	

Subcatchment 5P: DA#5P

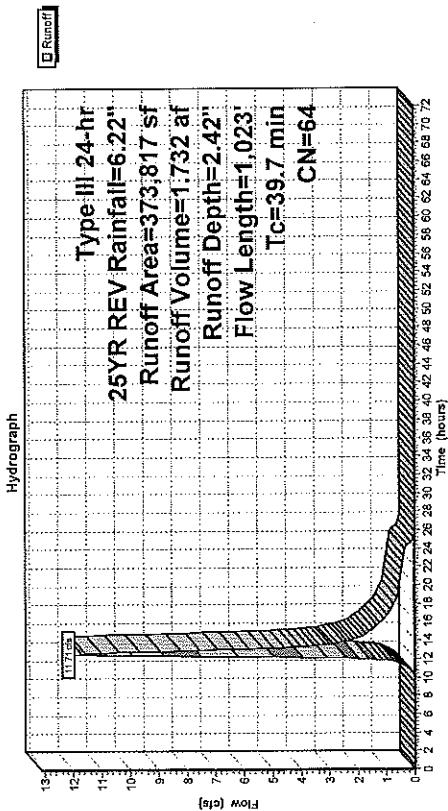
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Page 47

Subcatchment 6P: 6P



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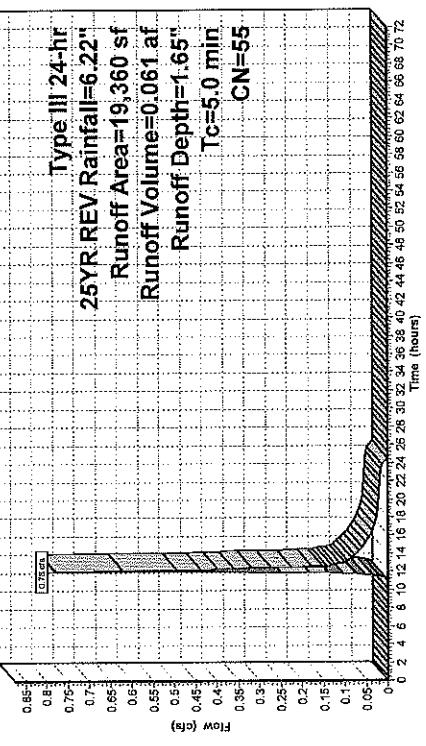
Type III 24-hr 25YR REV Rainfall=6.22"
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Page 47

Summary for Subcatchment 7P: DA#7P

Runoff	=	0.78 cfs @ 12.08 hrs, Volume=	0.061 af, Depth= 1.65"
Runoff by SCS TR-20 method, UH=SCS Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs			
Type III 24-hr 25YR REV Rainfall=6.22"			
Area (sf)	CN	Description	
19,360	55	Woods, Good, HSG B	
19,360		100.00% Perious Area	
Tc	Length	Slope	Capacity
(min)	(feet)	(ft/sec)	(cfs)
5.0			

Subcatchment 7P: DA#7P

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Page 49

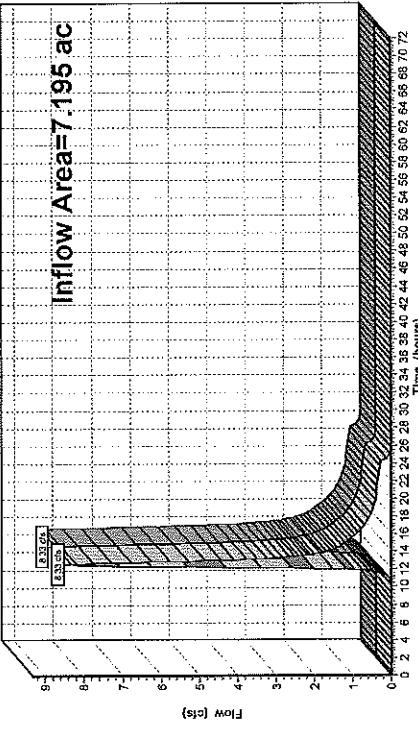
Summary for Reach IP#1: VERNAL POOL

Inflow Area = 7.195 ac, 7.66% Impervious, Inflow Depth = 2.07" for 25YR REV event
Inflow = 8.33 cfs @ 12.57 hrs, Volume= 1.239 af
Outflow = 8.33 cfs @ 12.57 hrs, Volume= 1.239 af, Atten= 0%, Lag= 0.0 min

Routing by StoR-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#1: VERNAL POOL

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Page 49

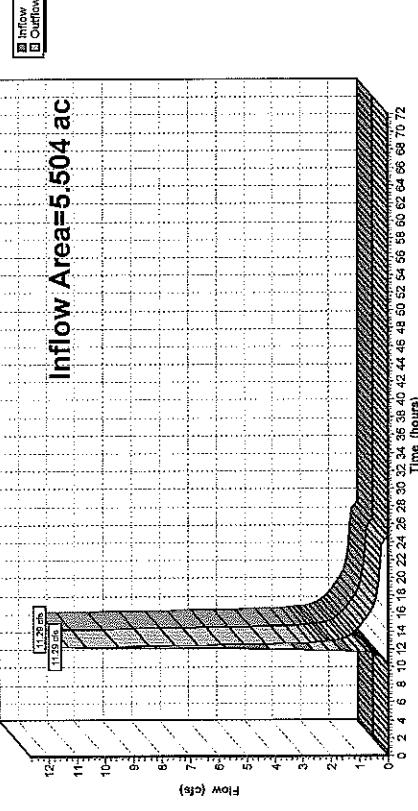
Summary for Reach IP#2: PROPLINE

Inflow Area = 5.504 ac, 9.66% Impervious, Inflow Depth = 2.33" for 25YR REV event
Inflow = 11.29 cfs @ 12.20 hrs, Volume= 1.069 af
Outflow = 11.29 cfs @ 12.20 hrs, Volume= 1.069 af, Atten= 0%, Lag= 0.0 min

Routing by StoR-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#2: PROPLINE

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Summary for Reach IP#3: WETLANDS

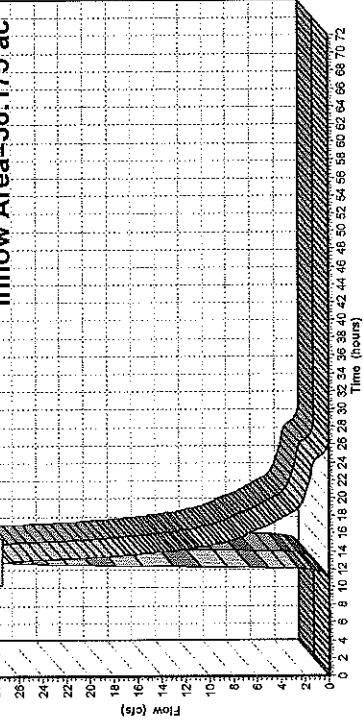
Inflow Area ≈ 36.175 ac, 13.65% Impervious, Inflow Depth = 2.14" for 25YR REV event
 Inflow = 26.71 cfs @ 12.84 hrs, Volume= 6.449 af
 Outflow = 26.71 cfs @ 12.84 hrs, Volume= 6.449 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#3: WETLANDS



Hydrograph



Inflow Area=36.175 ac

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 Page 51

Summary for Reach IP#4: PROP. LINE

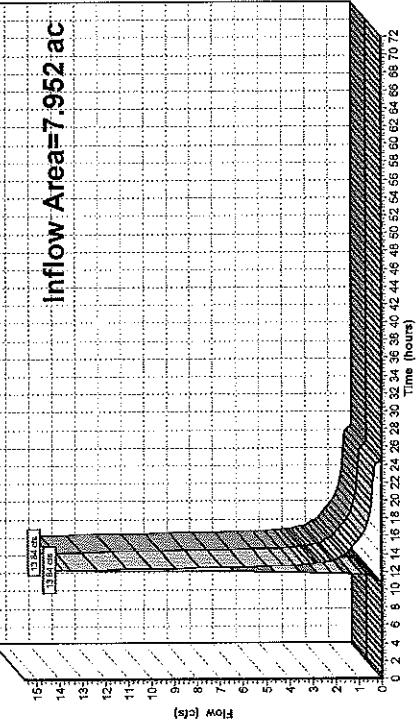
Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 2.07" for 25YR REV event
 Inflow ≈ 13.84 cfs @ 12.22 hrs, Volume= 1.370 af
 Outflow = 13.84 cfs @ 12.22 hrs, Volume= 1.370 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE



Hydrograph



Inflow Area=7.952 ac

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Summary for Reach IP#4: PROP. LINE

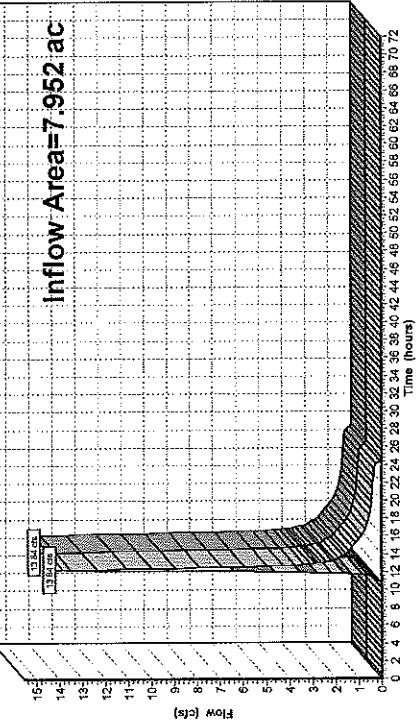
Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 2.07" for 25YR REV event
 Inflow ≈ 13.84 cfs @ 12.22 hrs, Volume= 1.370 af
 Outflow = 13.84 cfs @ 12.22 hrs, Volume= 1.370 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE



Hydrograph



Inflow Area=7.952 ac

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Page 53

Summary for Reach IP#5: PROP LINE

Inflow Area = 0.444 ac, 0.00% Impervious, Inflow Depth = 1.65" for 25YR REV event
 Inflow = 0.78 cfs @ 12.09 hrs, Volume= 0.051 af, Attenu= 0%, Lag= 0.0 min
 Outflow = 0.78 cfs @ 12.09 hrs, Volume= 0.051 af, Attenu= 0%, Lag= 0.0 min

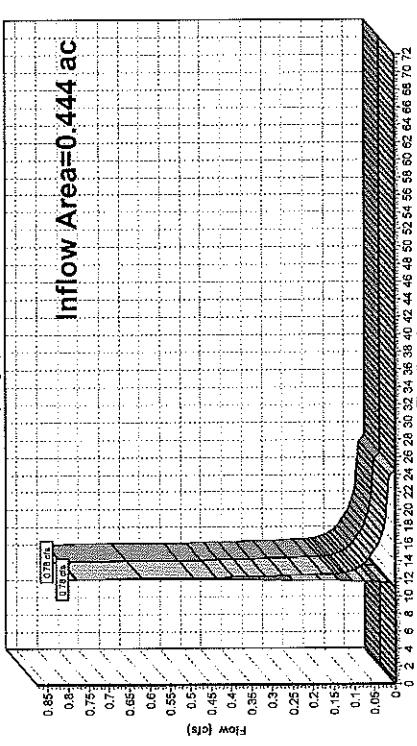
Routing by Star-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#5: PROP LINE

Hydrograph



Inflow Area=0.444 ac



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Page 54

Summary for Pond PND1: BASIN#1

Inflow Area = 8.791 ac, 34.42% Impervious, Inflow Depth = 3.27" for 25YR REV event
 Inflow = 20.93 cfs @ 12.34 hrs, Volume= 2.397 af, Attenu= 76%, Lag= 42.7 min
 Outflow = 4.98 cfs @ 13.05 hrs, Volume= 2.397 af
 Discarded = 0.31 cfs @ 13.05 hrs, Volume= 0.504 af
 Primary = 4.67 cfs @ 13.05 hrs, Volume= 1.893 af

Routing by Star-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 378.43' @ 13.05 hrs Surf.Area= 12.995 sf Storage= 44,354 cf

Plug-Flow detention time= 186.1 min calculated for 2.397 af (100% of inflow)
 Center-of-Mass det. time= 185.7 min (1,032.0 - 846.3)

Volume	Invert	Avail Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recalc)
#1	374.00'	82,639 cf		
Elevation	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
(feet)				
374.00	7,184	0	0	
376.00	9,656	16,850	16,850	
378.00	12,357	22,023	38,873	
380.00	15,306	27,653	66,536	
381.00	16,900	16,103	82,639	
Device	Routing	Invert	Outlet Devices	
#1	Discarded	374.00'	1.020 in/hr Exfiltration over Surface area	
#2	Primary	375.00'	6.0" Vert. Orifice/Grate C= 0.600	
#3	Primary	375.25'	8.0" Vert. Orifice/Grate C= 0.600	
#4	Primary	378.25'	12.0" Vert. Orifice/Grate C= 0.600	

Discarded OutFlow Max=0.31 cfs @ 13.05 hrs HW=378.43' (Free Discharge)

↓=1=Exfiltration (Exfiltration Controls 0.31 cfs)

Primary OutFlow Max=4.67 cfs @ 13.05 hrs HW=378.43' (Free Discharge)

↑=2=Office/Grate (Office Controls 1.69 cfs @ 8.59 fps)

=3=Office/Grate (Office Controls 2.84 cfs @ 8.13 fps)

=4=Office/Grate (Office Controls 0.14 cfs @ 1.45 fps)

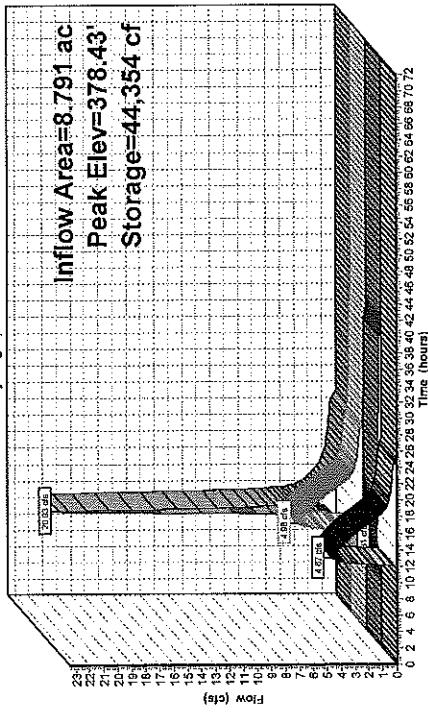
↓=1=Exfiltration (Exfiltration Controls 0.31 cfs)

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Type III 24-hr 25YR REV Rainfall=6.22"
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 Page 55

Pond PND1: BASIN#1

Hydrograph



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Type III 24-hr 25YR REV Rainfall=6.22"
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 Page 55

Summary for Pond PND2: BASIN#2

Inflow Area = 8.582 ac, 13.11% impervious. Inflow Depth = 2.42" for 25YR REV event
 Inflow = 11.71 cfs @ 12.58 hrs. Volume= 1.732 af
 Outflow = 6.51 cfs @ 13.04 hrs. Volume= 1.732 af. Atten= 44%, Lag= 27.5 min
 Primary = 0.18 cfs @ 13.04 hrs. Volume= 0.145 af
 Primary = 6.33 cfs @ 13.04 hrs. Volume= 1.587 af

Routing by Stor-Ind method. Time Span= 0.00-72.00 hrs. dt= 0.05 hrs
 Peak Elev= 372.97" @ 13.04 hrs Surf.Area= 7,809 sf Storage= 17,053 cf

Plug-Flow detention time= 41.6 min calculated for 1.731 af (100% of inflow)
 Center-of-Mass det. time= 41.7 min (923.5 - 881.8)

Volume	Invert	Avail Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recalc)
#1	370.00'	35,650 cf		

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
370.00	3,750	0	0
372.00	6,410	10,150	10,150
374.00	9,300	15,700	25,850
375.00	10,390	9,800	35,650

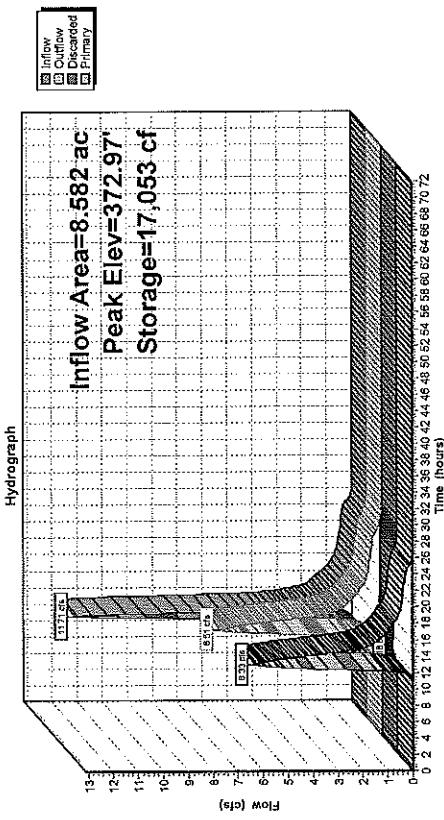
Discarded OutFlow Max=0.18 cfs @ 13.04 hrs HN=372.97" (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.18 cfs)
 Primary OutFlow Max=6.32 cfs @ 13.04 hrs HW=372.97" (Free Discharge)
2=Office/Grade (Office Controls 2.73 cfs @ 7.32 fps)
3=Office/Grade (Office Controls 3.53 cfs @ 6.41 fps)
4=Office/Grade (Office Controls 0.06 cfs @ 1.18 fps)

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Type III 24-hr 25YR REV Rainfall=6.22"
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 Page 57

Pond PND2: BASIN#2



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Type III 24-hr 50YR REV Rainfall=7.42"
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 Page 58

Summary for Subcatchment 1P: DA#1P

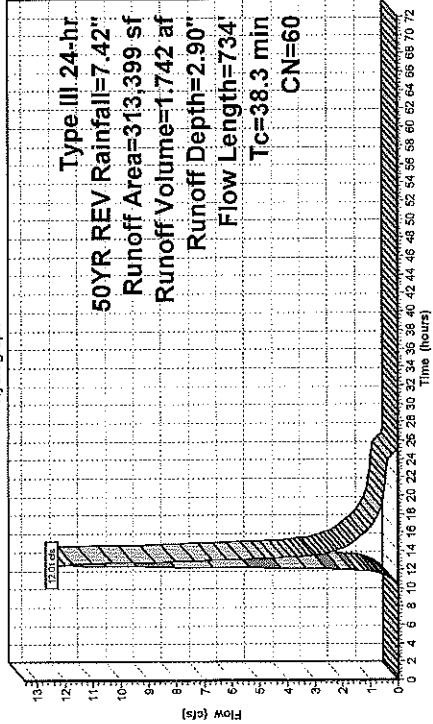
Runoff	=	12.01 cfs @ 12.56 hrs, Volume=	1.742 af, Depth= 2.90"	
Runoff by SCS TR-20 method	UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs			
Type III 24-hr 50YR REV Rainfall=7.42"				
Area (sf)	CN	Description		
24,004	98	Paved parking & roofs		
80,175	61	>75% Grass cover, Good, HSG B		
209,220	55	Woods, Good, HSG B		
313,399	60	Weighted Average		
289,355	60	92.34% PerVIOUS Area		
24,004		7.66% Impervious Area		
Tc	Length	Slope	Capacity	Description
(min)	(feet)	(feet)	(ft/sec)	(cfs)
28.3	50	0.0100	0.03	Sheet Flow, TRAVEL PATH A TO B
				Woods: Dense underbrush n= 0.800 P2= 3.20"
6.6	375	0.0360	0.95	Shallow Concentrated Flow, TRAVEL PATH B TO C
				Woodland Ky= 5.0 fps
0.3	100	0.0150	6.02	Pipe Channel, TRAVEL PATH D TO E
				12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
0.8	89	0.0150	1.84	Shallow Concentrated Flow, TRAVEL PATH E TO F
				n= 0.012 Concrete pipe, finished
2.3	120	0.0300	0.87	Grassed Waterway Ky= 15.0 fps
				Shallow Concentrated Flow, TRAVEL PATH F TO G
				Woodland Ky= 5.0 fps
38.3	734	Total		

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Type III 24-hr 50YR REV Rainfall=7.42"

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Page 59**Subcatchment 1P; DA#1P**

Hydrograph

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Type III 24-hr 50YR REV Rainfall=7.42"

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Page 60**Summary for Subcatchment 2P; DA#2P**

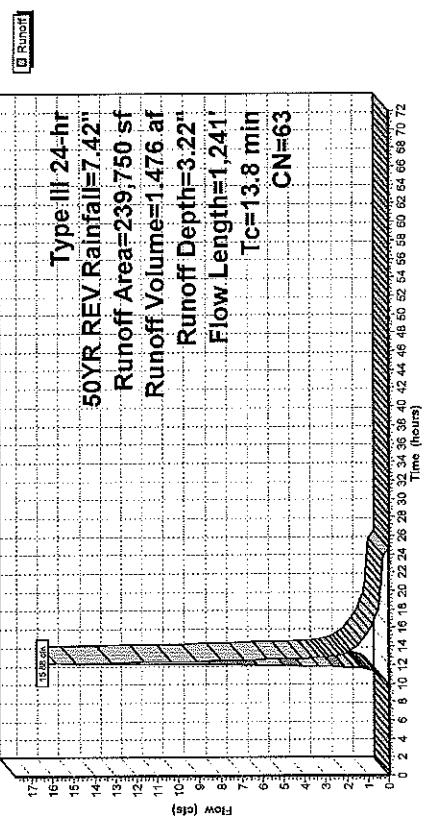
Runoff = 15.88 cfs @ 12.20 hrs. Volume= 1.476 af, Depth= 3.22"

Runoff by SCS TR-20 method. UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50YR REV Rainfall=7.42"

Area (sf)	CN	Description
23,199	98	Paved parking & roofs
127,802	61	>75% Grass cover, Good, HSG B
88,749	58	Woods/grass comb., Good, HSG B
239,750	63	Weighted Average
216,551		90.32% Pervious Area
23,199		9.68% Impervious Area
Tc=38.3 min		
CN=60		

Subcatchment 2P; DA#2P

Hydrograph



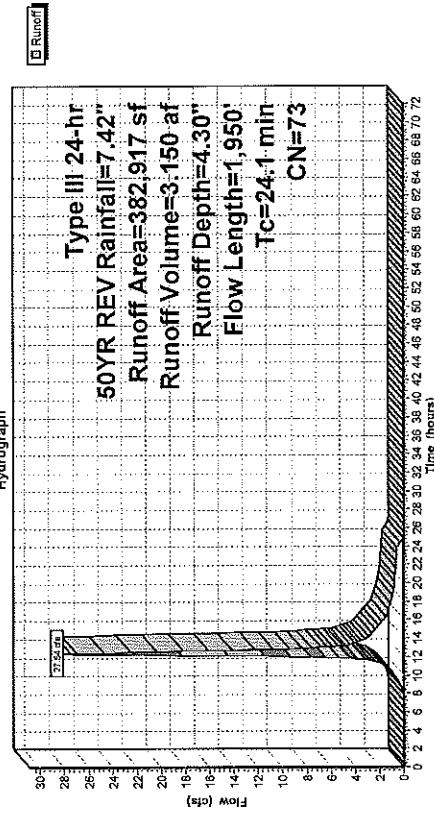
post development 1-17 Type III 24-hr 50YR REV Rainfall=7.42"
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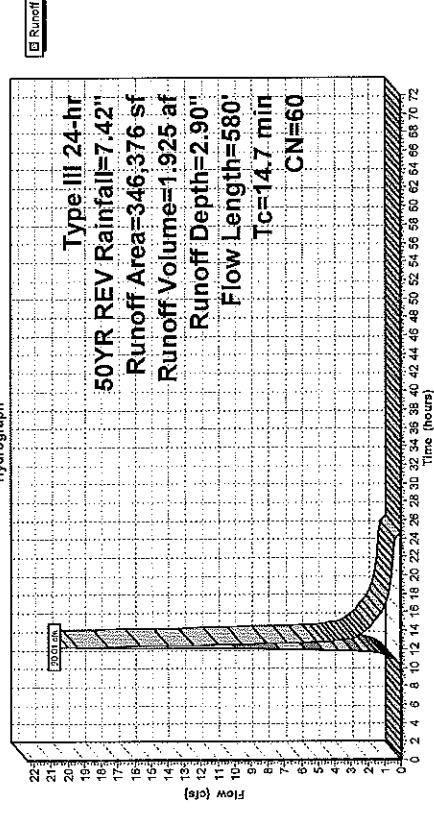
Summary for Subcatchment 3P: DA#3P

Tc	Length (min)	Slope (feet/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	50	0.0400	0.05	Sheet Flow, TRAVEL PATH A TO B	
				Woods: Dense underbrush n=0.800 P2=3.20"	
0.8	200	0.0600	3.94	Shallow Concentrated Flow, TRAVEL PATH B TO C	
				Umpaved Kv= 16.1 fps	
7.0	1,700	0.0400	4.06	Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Paved Kv= 20.3 fps	
24.1	1,950	Total			

Subcatchment 3P: DA#3P



Subcatchment 4P: DA#4P



Type III 24-hr 50YR REV Rainfall=7.42"
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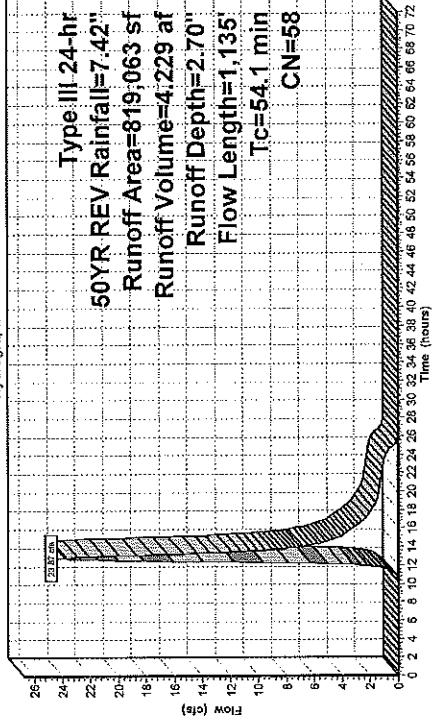
post development 1-17 Type III 24-hr 50 YR REV Rainfall=7.42"
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Summary for Subcatchment 5P: DA#55P

Runoff	=	23,87 cfs @ 12.78 hrs, Volume=	4,229 af, Depth= 2.70"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs			
Type III 24-hr 50YR REV Rainfall=7.42"			

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
21.5	50	0.0200	0.04	Street Flow, TRAVEL PATH A TO B Woods; Dense underbrush n=0.300 P2=3.20"	
31.2	935	0.0100	0.50	Shallow Concentrated Flow, TRAVEL PATH B TO C Woodland Kv= 5.0 tps	
1.4	150	0.0300	1.73	Shallow Concentrated Flow, TRAVEL PATH C TO D Nearly Bare & Untilled Kv=10.0 fps	

Submittal 5P: DA#5P



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Summary for Subcatchment 6P: 6P

Runoff = 16.34 cfs @ 12.57 hrs, Volume= 2,377 af, Depth= 3.32"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 50YR REV Rainfall=7.42"

Area (sf)	CN	Description
49,012	98	Paved parking, HSG B
206,262	61	>75% Grass cover, Good, HSG B
118,543	55	Woods, Good, HSG B
373,817	64	Weighted Average
324,805	86	85% PerVIOUS Area
49,012	13	11% ImperVIOUS Area

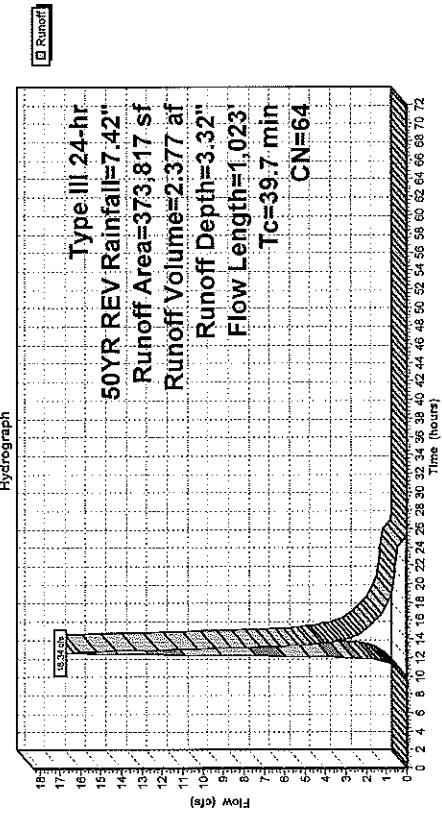
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.3	50	0.0300	0.05		Sheet Flow, TRAVEL PATH A TO B
					Woods: Dense underbrush n=0.800 P=3.20"
1.6	135	0.0800	1.41		Shallow Concentrated Flow, TRAVEL PATH B TO C
					Woodland Kv= 5.0 fps
19.4	555	0.0330	0.48	1.91	Traveler Rect Channel Flow, TRAVEL C TO D
					Bct.W=2.0' D=1.00' Z= 2.0' Top.W=6.00'
0.4	283	0.0500	11.99	9.42	Sheet flow over Bermuda Grass
					Pipe Channel, TRAVEL PATH D TO E
					12.0" Round Area=0.8 of Pennm = 3.1 r=0.25'
					n= 0.011 Concrete pipe, finished

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Page 65

Subcatchment 6P: 6P



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Page 66

Summary for Subcatchment 7P: DA#7P

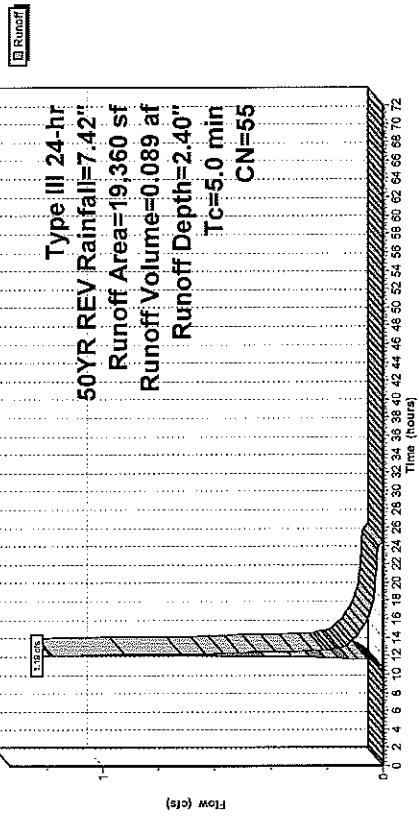
Runoff = 1.19 cfs @ 12.00 hrs, Volume= 0.059 af, Depth= 2.40"
Runoff by SCSTR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 50YR REV Rainfall=7.42"

Area (sf)	CN	Description
19,360	55	Woods, Good, HSG B
19,360	100.00%	Previous Area

Tc Length Slope Velocity Capacity Description
(min) (feet) (ft/ft) (ft/sec) (cfs) Direct Entry, TRAVEL TIME

Subcatchment 7P: DA#7P

Hydrograph



Type III 24-hr Rainfall=7.42"

Runoff Area=19,360 sf

Runoff Volume=0.089 af

Runoff Depth=2.40"

Tc=5.0 min

CN=55

Time (hours)

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Page 67

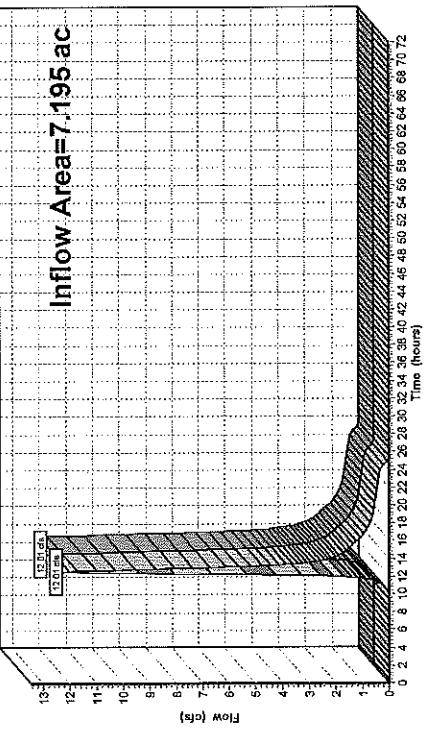
Summary for Reach IP#1: VERNAL POOL

Inflow Area = 7.195 ac, 7.66% Impervious, Inflow Depth = 2.90" for 50YR REV event
Inflow = 12.01 cfs @ 12.56 hrs, Volume= 1.742 af, Attenuation= 0%, Lag= 0.0 min
Outflow = 12.01 cfs @ 12.56 hrs, Volume= 1.742 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#1: VERNAL POOL

Hydrograph



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Page 68

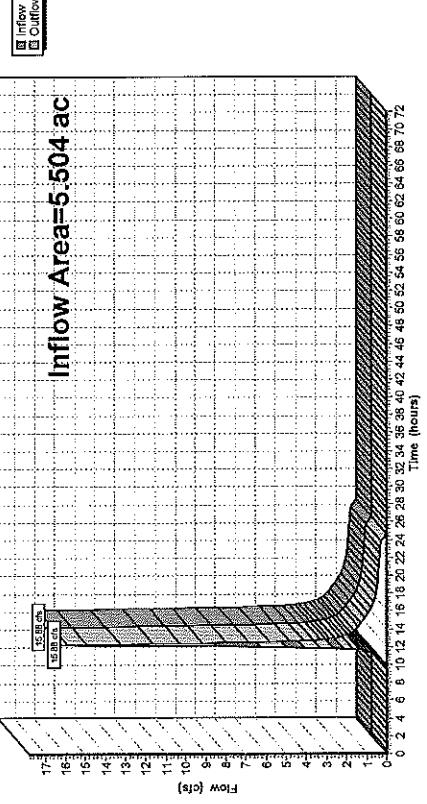
Summary for Reach IP#2: PROP LINE

Inflow Area = 5.504 ac, 9.68% impervious, Inflow Depth = 3.22" for 50YR REV event
Inflow = 15.88 cfs @ 12.20 hrs, Volume= 1.476 af, Attenu= 0%, Lag= 0.0 min
Outflow = 15.88 cfs @ 12.20 hrs, Volume= 1.476 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#2: PROP LINE

Hydrograph



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Page 69

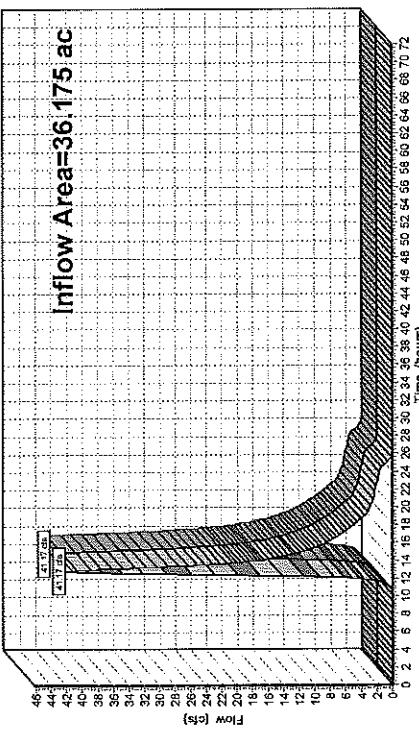
Summary for Reach IP#3: WETLANDS

Inflow Area = 36.175 ac, 13.65% Impervious, Inflow Depth = 3.01" for 50YR REV event
Inflow = 41.17 cfs @ 12.83 hrs, Volume= 9.085 af
Outflow = 41.17 cfs @ 12.83 hrs, Volume= 9.085 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#3: WETLANDS

Hydrograph



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Page 69

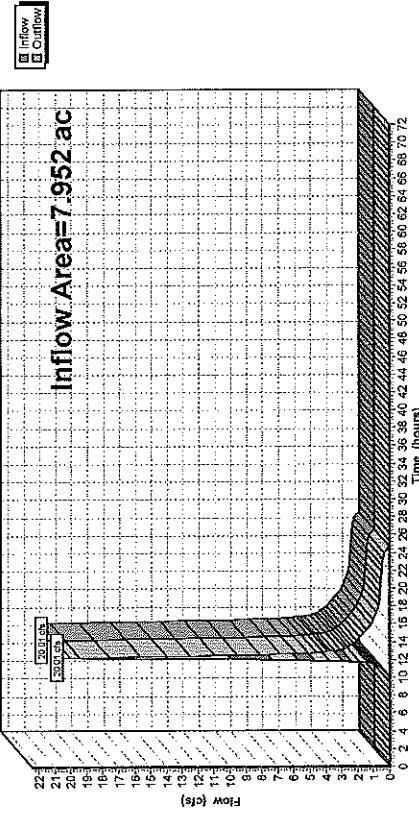
Summary for Reach IP#4: PROP. LINE

Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 2.90" for 50YR REV event
Inflow = 20.01 cfs @ 12.21 hrs, Volume= 1.925 af
Outflow = 20.01 cfs @ 12.21 hrs, Volume= 1.925 af, Atten= 0%, Lag= 0.0 min

Routing by Sto-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE

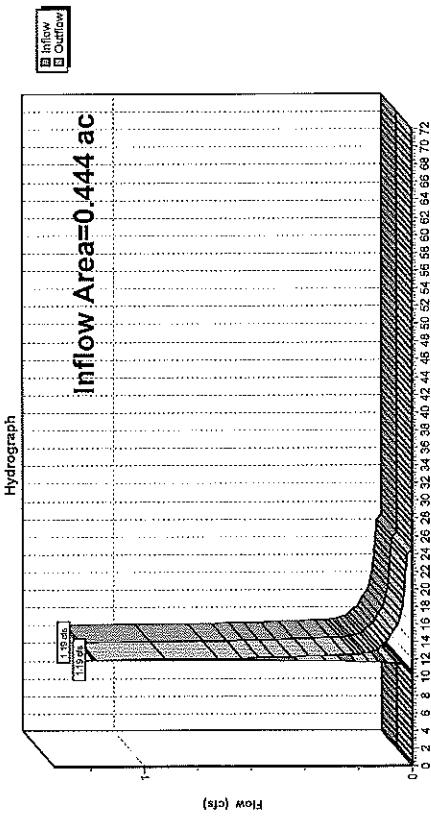
Hydrograph



Summary for Reach IP#5: PROP LINE

Inflow Area = 0.444 ac, 0.00% Impervious, Inflow Depth = 2.40" for 50YR REV event
 Inflow = 1.19 cfs @ 12.09 hrs, Volume= 0.058 af, Atten= 0%, Lag= 0.0 min
 Outflow = 1.19 cfs @ 12.09 hrs, Volume= 0.059 af, Atten= 0%, Lag= 0.0 min
 Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#5: PROP LINE



Summary for Pond PND1: BASIN#1

Inflow Area = 8.791 ac, 34.42% Impervious, Inflow Depth = 4.30" for 50YR REV event
 Inflow = 27.54 cfs @ 12.33 hrs, Volume= 3.150 af, Atten= 68%, Lag= 34.0 min
 Outflow = 8.45 cfs @ 12.90 hrs, Volume= 3.150 af, Atten= 68%, Lag= 34.0 min
 Discarded = 0.34 cfs @ 12.90 hrs, Volume= 0.532 af
 Primary = 8.11 cfs @ 12.90 hrs, Volume= 2.618 af
 Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 379.35' @ 12.90 hrs Surf.Area= 14,349 sf Storage= 56,915 cf

Plug-Flow detention time= 166.7 min calculated for 3.148 af (100% of inflow)
 Center-of-Mass det time= 167.3 min (1,005.7 - 838.4)

Volume	Invert	Avail Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recall:e)
#1	374.00'	82,639 cf		
Elevation	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	
(feet)				
374.00	7,184	0	0	
376.00	9,656	16,850	16,850	
378.00	12,357	22,023	38,873	
380.00	15,306	27,663	66,536	
381.00	16,900	16,103	82,639	
Device	Routing	Invert	Outlet Devices	
#1	Discarded	374.00'	1,020 in/hr Exfiltration over Surface area	
#2	Primary	375.00'	6.0" Vert. Orifice/Grate C= 0.600	
#3	Primary	375.25'	8.0" Vert. Orifice/Grate C= 0.600	
#4	Primary	378.25'	12.0" Vert. Orifice/Grate C= 0.600	

Discarded OutFlow Max=0.34 cfs @ 12.90 hrs HW=379.35' (Free Discharge)

1=Exfiltration (Exfiltration Controls 0.34 cfs)

Primary OutFlow Max=8.11 cfs @ 12.90 hrs HW=379.35' (Free Discharge)

2=Orifice/Grate (Orifice Controls 1.91 cfs @ 9.75 fps)

3=Orifice/Grate (Orifice Controls 3.26 cfs @ 9.35 fps)

4=Orifice/Grate (Orifice Controls 2.93 cfs @ 3.77 fps)

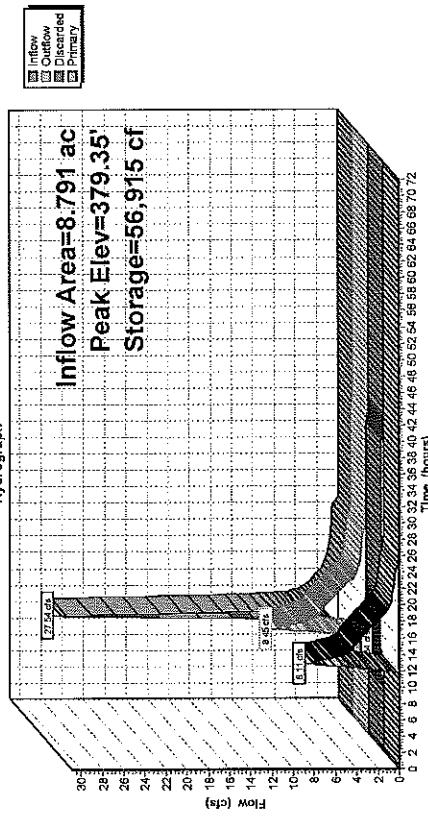
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Type III 24-hr 50YR REV Rainfall=7.42"
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 Page 73

Pond PND1: BASIN#1

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 Page 74

Summary for Pond PND2: BASIN#2

Inflow Area = 8.582 ac, 13.11% impervious, Inflow Depth = 3.32" for 50YR REV event
 Inflow = 16.34 cfs @ 12.57 hrs, Volume = 2.377 af
 Outflow = 9.99 cfs @ 12.97 hrs, Volume = 2.377 af, Attenu = 39%, Lag = 23.9 min
 Discardd = 0.21 cfs @ 12.97 hrs, Volume = 0.160 af
 Primary = 9.78 cfs @ 12.97 hrs, Volume = 2.218 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 373.76' @ 12.97 hrs Surf.Area= 8.954 sf Storage= 23,674 cf

Plug-Flow detention time= 41.1 min calculated for 2,376 af (100% of inflow)
 Center-of-Mass det. time= 41.2 min (913.6 - 872.5)

Volume	Invert	Avail.Storage	Storage Description
#1	370.00'	35,650 cf	Custom Stage Data [Prismatic] Listed below (Recalc)

Elevation (feet)	SurfArea (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
370.00	3,750	0	0
372.00	6,400	10,150	10,150
374.00	9,300	15,700	25,850
375.00	10,300	9,800	35,650

Device	Routing	Invert	Outlet Devices
#1	Discarded	370.00	1.020 in/hr Exfiltration over Surface area
#2	Primary	370.00'	8.0" Vert. Orifice/Grate C= 0.600
#3	Primary	370.75'	10.0" Vert. Orifice/Grate C= 0.600
#4	Primary	372.85'	12.0" Vert. Orifice/Grate C= 0.600

Discarded OutFlow Max=0.21 cfs @ 12.97 hrs HW=373.76' (Free Discharge)

↓-1=Exfiltration (Exfiltration Controls 0.21 cfs)

Primary OutFlow Max=9.78 cfs @ 12.97 hrs HW=373.76' (Free Discharge)

↓-2=Office/Grate (Orifice Controls 3.11 cfs @ 8.91 fps)

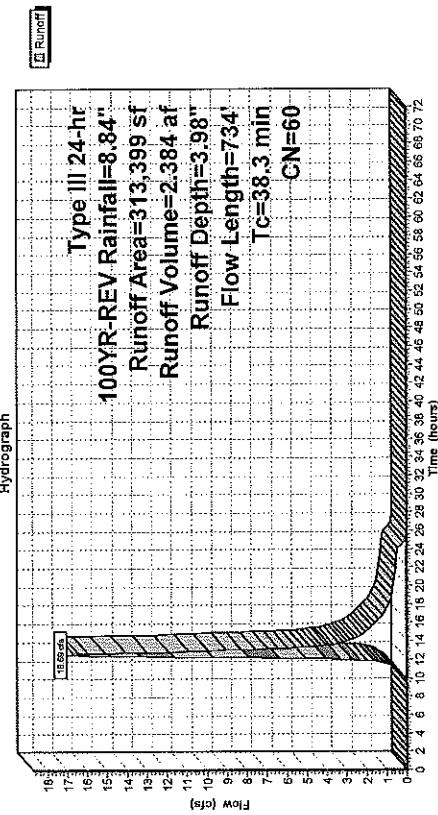
↓-3=Office/Grate (Orifice Controls 4.23 cfs @ 7.75 ips)

↓-4=Office/Grate (Orifice Controls 2.44 cfs @ 3.25 ips)

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Type III 24-hr 100YR-REV Rainfall=8.84"
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Page 77

Subcatchment 1P: DA#P



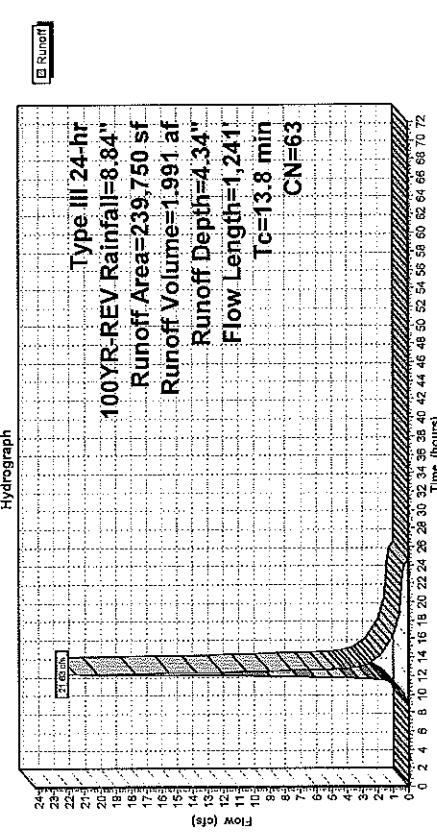
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Page 78

Summary for Subcatchment 2P: DA#2P

Runoff	=	21.63 cfs @ 12.20 hrs.	Volume=	1.991 af, Depth= 4.34"	
Runoff by SCS TR-20 method, UH=SCS Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs					
Type III 24-hr 100YR-REV Rainfall=8.84"					
Area (sf)	CN	Description			
23,199	98	Paved parking & roofs			
127,842	61	>75% Grass cover, Good, HSG B			
88,779	58	Woods/grass comb., Good, HSG B			
239,750	63	Weighted Average			
216,551		90.32% Pervious Area			
23,199		9.68% Impervious Area			
Tc (min)	Length (feet)	Slope (feet/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	50	0.0100	0.11	0.11	Street Flow, TRAVEL PATH A TO B
5.0	1,081	0.0500	3.60	3.60	Grass: Short n= 0.150 P2= 3.20"
1.4	110	0.0720	1.34	1.34	Shallow Concentrated Flow, TRAVEL PATH B TO C Unpaved Kv= 16.1 fps
13.8	1,241 Total				Shallow Concentrated Flow, TRAVEL PATH C TO D Woodland Kv= 5.0 fps

Subcatchment 2P: DA#2P



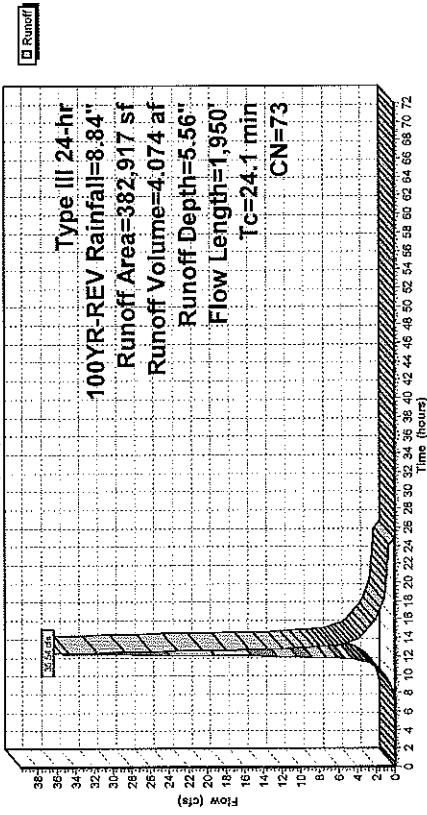
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Page 79

Summary for Subcatchment 3B: DA#3P

Runoff	mm	35.54 cfs @	12.33 hrs, Volume=	4.074 af, Depth= 5.56"
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs				
Type III 24-hr 100YR-REV Rainfall=8.84"				
Tc	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)
(min)				Description
16.3	50	0.0400	0.05	Street Flow, TRAVEL PATH A TO B
0.8	200	0.0600	3.94	Woods: Dense underbrush n= 0.800 P= 3.20"
7.0	1,700	0.0400	4.06	Shallow Concentrated Flow, TRAVEL PATH B TO C Unpaved Kv= 16.1 tps Shallow Concentrated Flow, TRAVEL PATH C TO D Paved Kv= 20.3 tps
				Total 1,950

Subcatchment 3P: DA#3P



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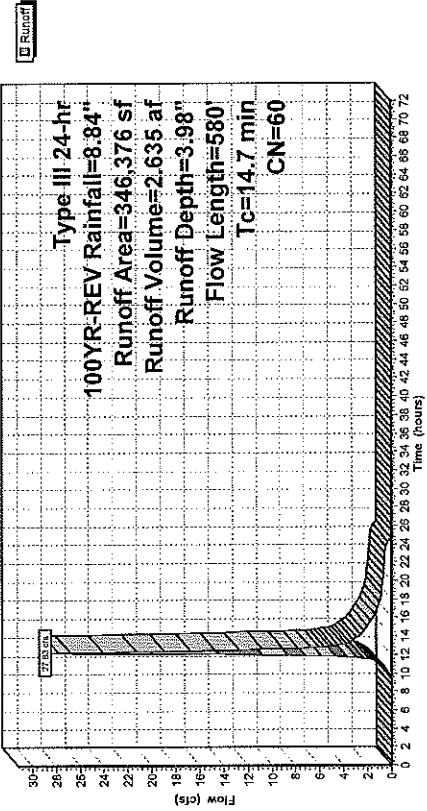
Summary for Sulfate catchment 4P: DA#4P

Runoff = 27.83 cfs @ 12.21 hrs, Volume= 2.635 af, Depth= 3.98"
 Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Type III 24-hr 100YR-REV Rainfall=8.84"

Area (sq mi)	CN	Description
--------------	----	-------------

Tc (min)	Length (feet)	Slope	Velocity (ft/sec)	Capacity (cfs)	Description
5.1	50	0.0250	0.16	Sheet Flow, TRAVEL PATH A TO B	
0.3	80	0.0750	4.41	Grass: Short n= 0.150 P2= 3.20"	
9.3	450	0.0260	0.81	Shallow Concentrated Flow, TRAVEL PATH B TO C	
14.7	580	Total		Unpaved Kv= 16.1 fps	
				Shallow Concentrated Flow, TRAVEL PATH C TO D	
				Woodland Kv= 5.0 fps	

Subcatchment 4P: DA#4P

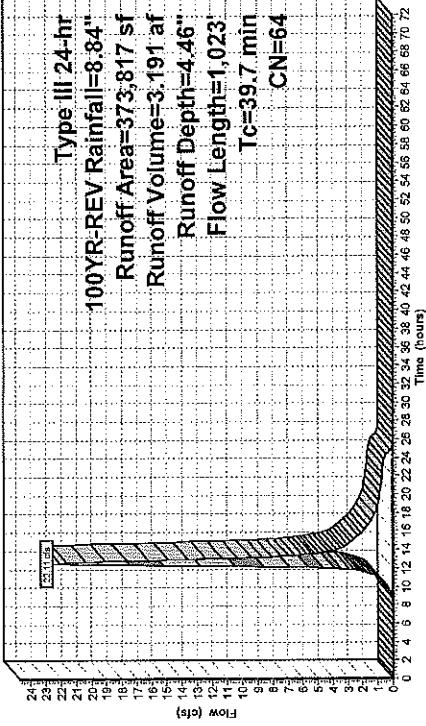


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Page 83

Subcatchment 6P: 6P

Hydrograph



Type III 24-hr
100YR-REV Rainfall=8.84"
Runoff Area=37.3,817 sf
Runoff Volume=3,191 af
Runoff Depth=4.46"
Flow Length=1,023
Tc=39.7 min
CN=64

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Page 84

Summary for Subcatchment 7P: DA#7P

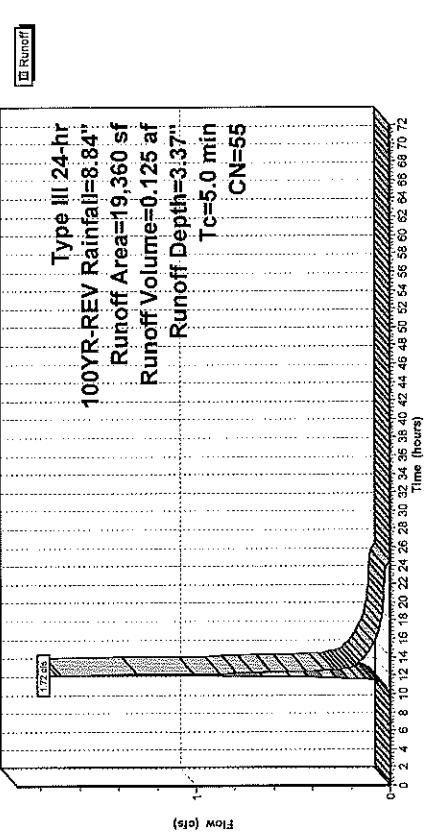
Runoff = 1.72 cfs @ 12.08 hrs, Volume= 0.125 af, Depth= 3.37"
Runoff by SCS TR-20 method, UH=SCS Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100YR-REV Rainfall=8.84"

Area (sf)	CN	Description
19,350	55	Woods, Good, HSG B
19,360	100.00%	Previous Area

Tc Length Slope Capacity Description
(min) (feet) (ft/ft) (ft/sec) (cfs)
5.0 Direct Entry, TRAVEL TIME

Subcatchment 7P: DA#7P

Hydrograph



Type III 24-hr
100YR-REV Rainfall=8.84"
Runoff Area=19,360 sf
Runoff Volume=0.125 af
Runoff Depth=3.37"

Tc=5.0 min
CN=55

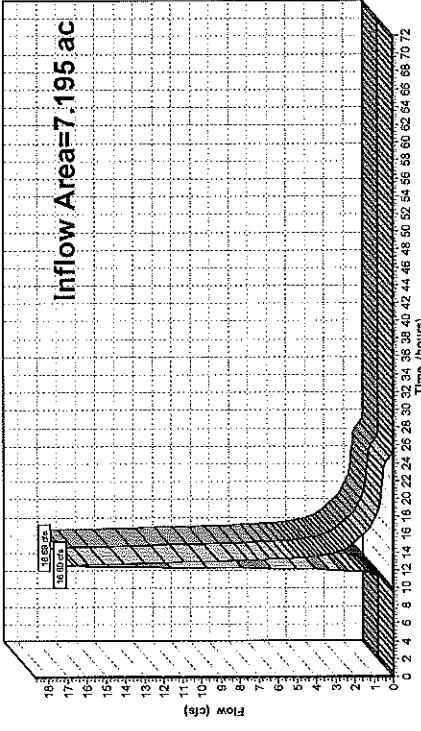
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HydroCAD® 10.00-16 s/n 01433 © 2015 HydroCAD Software Solutions LLCType III/24-hr 100YR-REV Rainfall=8.84"
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Page 85**Summary for Reach IP#1: VERNAL POOL**

Inflow Area = 7.195 ac, 7.66% Impervious, Inflow Depth = 3.98" for 100YR-REV event
 Inflow = 16.69 cfs @ 12.55 hrs, Volume= 2.384 af, Attenu= 0%, Lag= 0.0 min
 Outflow = 16.69 cfs @ 12.55 hrs, Volume= 2.384 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#1: VERNAL POOL

Hydrograph

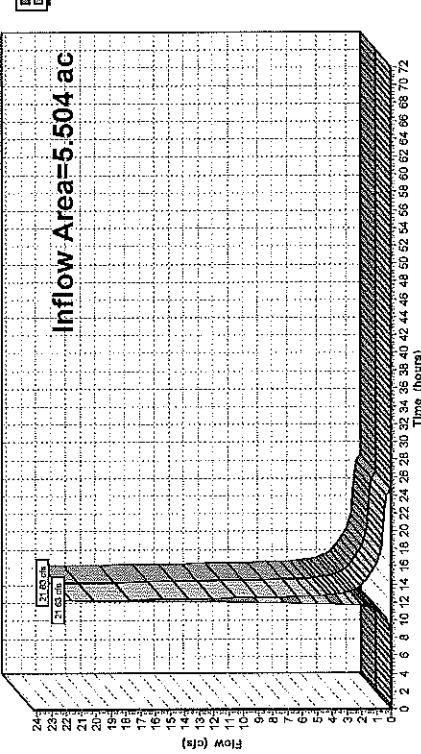
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HydroCAD® 10.00-16 s/n 01433 © 2015 HydroCAD Software Solutions LLCType III/24-hr 100YR-REV Rainfall=8.84"
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Page 86**Summary for Reach IP#2: PROPLINE**

Inflow Area = 5.504 ac, 9.68% Impervious, Inflow Depth = 4.34" for 100YR-REV event
 Inflow = 21.63 cfs @ 12.20 hrs, Volume= 1.981 af
 Outflow = 21.63 cfs @ 12.20 hrs, Volume= 1.981 af, Attenu= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#2: PROPLINE

Hydrograph



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Page 87

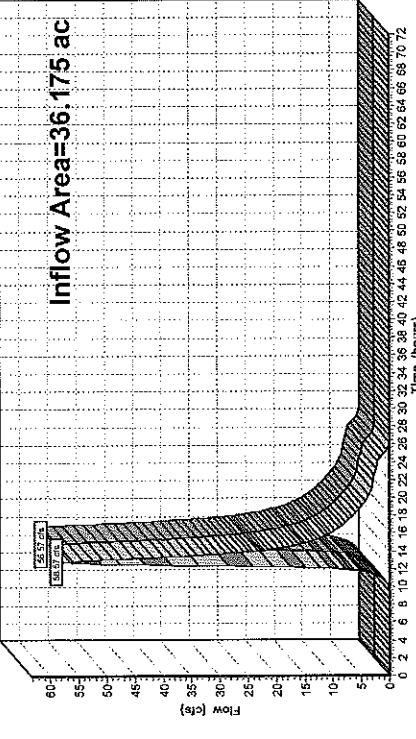
Summary for Reach IP#3: WETLANDS

Inflow Area = 36.175 ac, 13.65% Impervious, Inflow Depth = 4.11" for 100YR-REV event
Inflow = 56.57 cfs @ 12.80 hrs, Volume= 12.379 af
Outflow = 56.57 cfs @ 12.80 hrs, Volume= 12.379 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#3: WETLANDS

Hydrograph



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Page 88

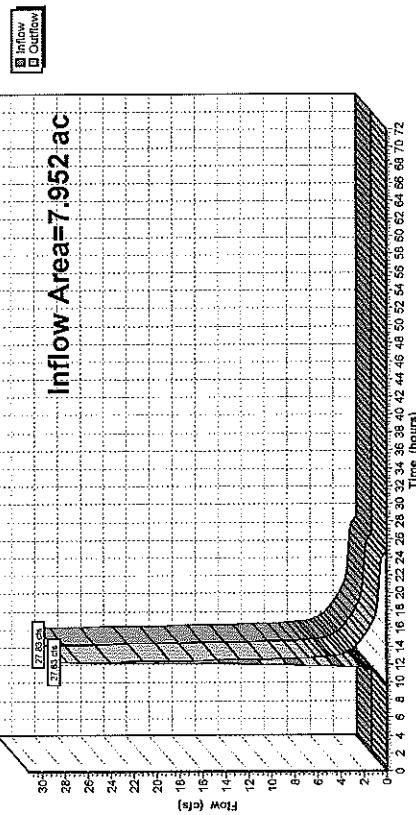
Summary for Reach IP#4: PROP. LINE

Inflow Area = 7.952 ac, 4.43% Impervious, Inflow Depth = 3.98" for 100YR-REV event
Inflow = 27.83 cfs @ 12.21 hrs, Volume= 2.635 af
Outflow = 27.83 cfs @ 12.21 hrs, Volume= 2.635 af, Atten= 0%, Lag= 0.0 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#4: PROP. LINE

Hydrograph



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 Page 89

Summary for Reach IP#5: PROP LINE

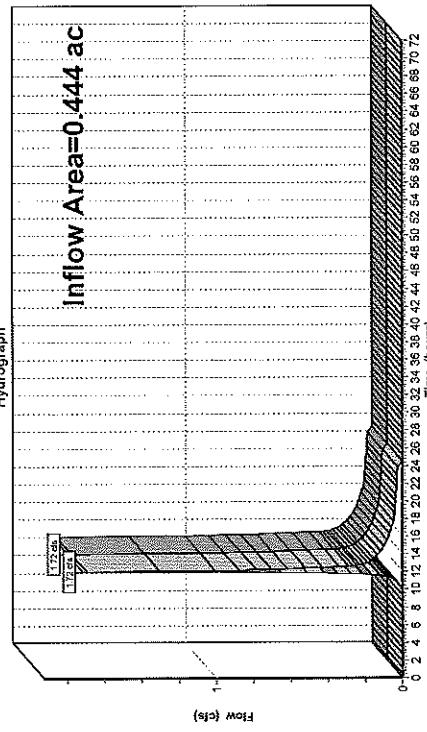
Inflow Area = 0.444 ac. 0.00% Impervious. Inflow Depth = 3.37" for 100YR-REV event
 Inflow = 1.72 cfs @ 12.08 hrs. Volume= 0.125 af.
 Outflow = 1.72 cfs @ 12.08 hrs. Volume= 0.125 af. Atten= 0%, Lag= 0.0 min
 Routing by StoI-Ind+Trans method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach IP#5: PROP LINE



Inflow Area=0.444 ac

Hydrograph



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 Page 90

Summary for Pond PND1: BASIN#1

Inflow Area = 8.791 ac. 34.42% Impervious. Inflow Depth = 5.56" for 100YR-REV event
 Inflow = 35.54 cfs @ 12.33 hrs. Volume= 4.074 af.
 Outflow = 11.05 cfs @ 12.88 hrs. Volume= 4.074 af. Atten= 69%, Lag= 33.2 min
 Discarded = 0.38 cfs @ 12.88 hrs. Volume= 0.551 af.
 Primary = 10.67 cfs @ 12.88 hrs. Volume= 3.512 af

Routing by StoI-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 380.39' @ 12.88 hrs. Surf.Area= 15,927 sf. Storage= 72,625 cf

Plug-Flow detention time= 151.9 min calculated for 4.071 af (100% of inflow)
 Center-of-Mass det. time= 152.5 min (983.6 - 831.1)

Volume	Invert	Avail.Storage	Storage Description	Custom Stage Data (Prismatic) Listed below (Recalc)
#1	374.00'	82,639 cf		
Elevation	Surf.Area (sq-ft)	Incl.Store (cubic-feet)	Cuml.Store (cubic-feet)	
(feet)				
374.00	7,184	0	0	
376.00	9,666	16,850	16,850	
378.00	12,357	22,023	38,873	
380.00	15,306	27,663	66,536	
381.00	16,900	16,103	82,639	
Device	Routing	Invert	Outlet Devices	
#1	Discarded	374.00'	1,020 in/hr Exfiltration over Surface area	
#2	Primary	375.00'	6.0" Vert. Orifice/Grate C= 0.600	
#3	Primary	375.25'	8.0" Vert. Orifice/Grate C= 0.600	
#4	Primary	378.25'	12.0" Vert. Orifice/Grate C= 0.600	

Discarded OutFlow Max=0.38 cfs @ 12.88 hrs HW=380.39' (Free Discharge)

↓=1=Exfiltration (Exfiltration Controls 0.38 cfs)

Primary OutFlow Max=10.67 cfs @ 12.88 hrs HW=380.39' (Free Discharge)

↑=2=Office/Grate (Orifice Controls 2.14 cfs @ 10.91 fps)

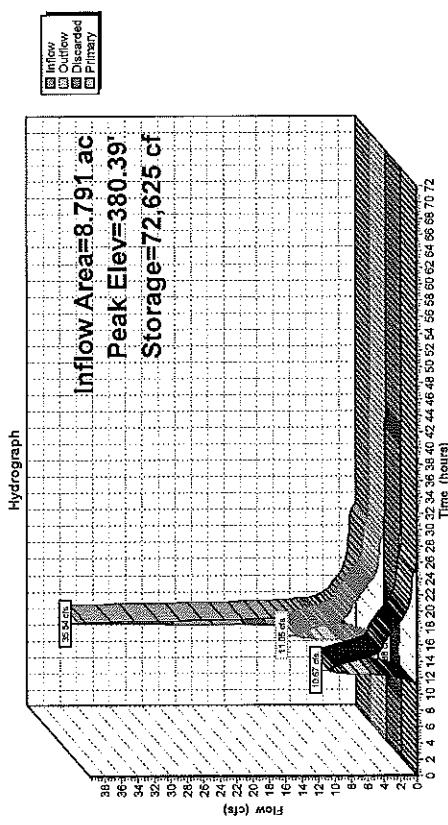
↓=3=Office/Grate (Orifice Controls 3.68 cfs @ 10.35 fps)

↓=4=Office/Grate (Orifice Controls 4.84 cfs @ 6.16 fps)

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 Page 91

Pond PND1: BASIN#1



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 Page 91

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 Page 92

Summary for Pond PND2: BASIN#2

Inflow Area = 8.582 ac, 13.11% Impervious, Inflow Depth = 4.46" for 100YR-REV event
 Inflow = 22.11 cfs @ 12.56 hrs, Volume= 3.191 af, Attenu= 41%, Lag= 24.9 min
 Outflow = 13.01 cfs @ 12.97 hrs, Volume= 3.191 af
 Discarded = 0.24 cfs @ 12.97 hrs, Volume= 0.175 af
 Primary = 12.77 cfs @ 12.97 hrs, Volume= 3.016 af

Routing by Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
 Peak Elev= 374.67' @ 12.97 hrs Surf.Area= 9,974 sf Storage= 32,344 cf
 Plug-Flow detention time= 40.8 min calculated for 3:189 af (100% of inflow)
 Center-of-Mass det. time= 40.8 min (904.7 - 863.9)

Volume	Invert	Avail.Storage	Storage Description
#1	370.00'	35,650 cf	Custom Stage Data (Prismatic) - Listed below (Recalc)
Elevation	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
(feet)			
370.00	3,750	0	0
372.00	6,400	10,150	10,150
374.00	9,300	15,700	25,850
375.00	10,300	9,800	35,650

Device Routing Invert Outlet Devices

#1	Discarded	370.00	1.020 in/hr Exfiltration over Surface area
#2	Primary	370.00	8.0" Vert. Orifice/Grate C= 0.600
#3	Primary	370.75	10.0" Vert. Orifice/Grate C= 0.800
#4	Primary	372.85	12.0" Vert. Orifice/Grate C= 0.600

Discarded OutFlow Max=0.24 cfs @ 12.97 hrs HW=374.67' (Free Discharge)
 ↓
 1=Exfiltration (Exfiltration Controls 0.24 cfs)

Primary OutFlow Max=12.76 cfs @ 12.97 hrs HW=374.67' (Free Discharge),
 ↓
 2=Office/Grate (Orifice Controls 3.50 cfs @ 10.03 fps)
 ↓
 3=Office/Grate (Orifice Controls 4.92 cfs @ 9.01 fps)
 ↓
 4=Office/Grate (Orifice Controls 4.35 cfs @ 5.53 fps)

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Printed 5/22/2017
Page 93

Pond PND2: BASIN#2

